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The role of doubt in bulimia nervosa

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Thèse présentée en vue de l'obtention du grade de PhD en psychologie recherche et intervention, option clinique

Décembre 2017

Résumé

La boulimie nerveuse (BN) est un trouble de santé mentale sévère qui implique une restriction alimentaire, une perte de contrôle sur l'alimentation et le recours à des comportements compensatoires. La BN, tout comme d'autres troubles alimentaires (TA), implique un taux de comorbidité élevé avec le trouble obsessionnel-compulsif (TOC), en plus de similarités importantes sur les plans symptomatologique et phénoménologique. Nombre d'études font état de l'importance du doute pathologique chez le TOC, et il semblerait que cet aspect cognitif serait commun au TOC et à la BN. Selon l'approche basée sur les inférences (ABI) pour le TOC, le doute pathologique serait élicité par un processus de raisonnement inductif erroné, connu sous le nom de « confusion inférentielle ». Ce construit consiste en deux composantes : une tendance à se fier indûment sur des informations basées sur des possibilités, ainsi qu'une méfiance envers ses sens. Par conséquent, la présente étude a cherché à tester la pertinence de la confusion inférentielle chez la BN.

Des participantes avec la BN (n = 25) et un groupe de participantes témoins sains (TS) (n = 25) ont été recrutés. Les premier et deuxième articles ont évalué la première composante de la confusion inférentielle, soit la tendance à se fier indûment sur des informations basées sur des possibilités, en utilisant les versions adaptées de le *Reasoning with Inductive Arguments Task* (RIAT) et l'*Inference Processes Task* (IPT), lesquelles ont été validées au près d'échantillons TOC comme étant des mesures du doute. Le *Fear of Self Questionnaire* (FSQ) fût également administré afin d'évaluer la tendance à se reconnaitre dans une potentielle identité redoutée, un construit relié à la confusion inférentielle. L'ensemble des résultats ont indiqué une tendance chez le groupe BN à se fier indûment sur des informations basées sur des possibilités, et ce pour les deux tâches. Le groupe BN a également montré des

taux plus élevés de soi redouté comparativement au groupe TS, le tout suggérant une plus forte tendance à s'identifier à un soi potentiel redouté.

Le troisième article de thèse fait état des résultats d'une tâche de vérification corporelle qui fût développée afin d'examiner l'association entre l'attention persévérante portée sur le corps et la méfiance envers ses sens (c.-à-d., une des deux composantes de la confusion inférentielle), laquelle fût opérationnalisée en tant que la confiance perceptuelle. Le groupe BN démontra une plus forte méfiance envers les sens suite à la vérification corporelle prolongée, comparativement au groupe TS, tel qu'indiqué par une diminution pré-post vérification corporelle de la confiance perceptuelle. Pour les trois articles de thèse, on a noté que les résultats des tâches expérimentales de raisonnement et de vérification corporelle étaient corrélés aux mesures auto-rapportées de symptômes du TA. Ces résultats soulignent l'importance clinique de la confusion inférentielle.

Somme toute, les résultats de cette thèse appuient la pertinence du doute pathologique élicité par la confusion inférentielle pour la BN ainsi que le lien entre la confusion inférentielle et la symptomatologie du TA.

Mots clés : boulimie nerveuse, trouble obsessionnel-compulsif, approche basée sur les inférences, confusion inférentielle

Abstract

Bulimia nervosa (BN) is a severe mental health disorder characterized by dietary restriction, the experience of loss of control over eating, and the use of compensatory behaviours. BN, like other eating disorders (EDs), has an elevated rate of comorbidity with obsessive compulsive disorder (OCD) as well as important similarities in terms of phenomenology and clinical features. Pathological doubt, consistently demonstrated as relevant in OCD, represents another cognitive feature potentially shared between OCD and BN. According to the inference based approach (IBA) to OCD, pathological doubt is elicited by a faulty inductive reasoning process termed 'inferential confusion'. This construct is comprised of two components: the over-investment in possibility-based information and distrust of the senses. Thus, the present study sought to test the role of inferential confusion to BN. Participants with BN (n = 25) and healthy control (HC) participants (n = 25) were recruited.

The first and second thesis articles evaluated the over-investment in possibility-based information component of inferential confusion using adapted versions of the Reasoning with Inductive Arguments Task (RIAT) and Inference Processes Task (IPT), both of which have been validated as analogues of doubt in OCD samples. The Fear of Self Questionnaire (FSQ) was also administered to evaluate investment in a feared possible identity, a construct related to inferential confusion. The BN group demonstrated a pattern of results consistent with an over-investment in possibility-based information on both tasks. The BN group also evinced higher levels of fear of self as compared to the HC group, suggesting over-investment in a feared possible self.

The third thesis article describes the results of a body checking task designed to examine the relationship between perseverative attending to the body and the distrust of the

senses component of inferential confusion, operationalized as perceptual confidence. The BN group experienced greater distrust of the senses due to prolonged body checking than the HC group as indicated by decreases in perceptual confidence from pre- to post-body checking. In all three thesis articles, it was found that the results of the experimental reasoning and body checking tasks were correlated with self-report measures of ED symptomatology. This highlights the clinical importance of inferential confusion.

Overall, the results of the present thesis suggest the relevance of pathological doubt elicited by inferential confusion in BN, as well as demonstrate a link between inferential confusion and ED symptomatology.

Keywords: bulimia nervosa, obsessive compulsive disorder, inference based approach, inferential confusion

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List of abbreviations

AN: anorexia nervosa

ANOVA: analysis of variance

APA: American Psychiatric Association

BCT: body checking task

BCQ: Body Checking Questionnaire

BMI: body mass index

BN: bulimia nervosa

BSQ-8C: Body Shape Questionnaire, version 8C

CBT-E: enhanced cognitive behavioural therapy

DSED: Distrust of the Senses in Eating Disorders scale

DSM: Diagnostic and Statistical Manual

EAT-26: Eating Attitudes Test, 26 items

EDs: eating disorders

EDE: Eating Disorders Examination

FSQ: Fear of Self Questionnaire

HC: healthy control

IBA: inference based approach

IBT: inference based therapy

ICQ-EV: Inferential Confusion Questionnaire – Expanded Version

IPT: Inference Processes Task

OCD: obsessive compulsive disorder

RIAT: Reasoning with Inductive Arguments Task

SCID-I: Structured Clinical Interview for DSM-IV Axis I disorders

VAS: visual analogue scale

'Choosing doubt as a philosophy of life is akin to choosing immobility as a means of transportation' -Yann Martel

Acknowledgements

The time spent completing my doctorate has been both challenging and rewarding. I graduate with a better understanding of myself and a greater sense of purpose due to having had the privilege of meeting inspiring and brilliant individuals.

I would like to begin by acknowledging the support of my supervisor, Kieron O'Connor and co-supervisor, Frederick Aardema. I was truly fortunate to have such hardworking and knowledgeable people in my corner throughout this process. I feel better prepared and more equipped as an aspiring researcher and clinician for having had the privilege of learning from you. Thank you, Fred, for your invaluable guidance and help throughout this process. Kieron, thank you for always being there for me, for your sense of humour, and for the many opportunities you gave me.

My graduate research was also supported by the Canadian Institutes of Health Research and the Fonds de Recherche du Québec – Santé, for which I am very grateful.

I would also like to acknowledge the support and camaraderie of current and past members of the CRIUSMM: Karine, Benjamin, Jean-Sébastien, Melha, Natalia, Stella, Charles-Édouard, Marie-Ève, Magali, and Sarah. In particular, I would like to thank Catherine Ouellet-Courtois for her support and friendship. I have really appreciated working with you over the years through our time as undergrads, as RA's, and eventually as grad students.

I am also grateful for the friendship and support I received from my classmates at UdeM. Through early morning classes, long days at the CUP, and late-night 'vin et fromages', I truly appreciated your enthusiasm and support. I am particularly grateful to Vickie Auclair for being a caring friend and the best stage-mate. For helping me to develop as a clinician, I would like to recognize the support and guidance of my clinical supervisors: Jean Gagnon,

Michelle Alain, Danielle Amado, and Marie-Christine Laferrière-Simard. For teaching me about resilience, empathy, and courage, I am indebted to my clients and research participants. Thank you for the faith you put in me and for the opportunity to become a part of your journey.

I would like to thank my family for their unwavering support and for teaching me the importance of helping others. I would like to thank my mom, Tammy Smith, for her hard work and for instilling in me a passion for reading and learning. This has been invaluable to me in my graduate studies and has shaped who I am today. I would like to thank my dad, Gordon Wilson, for helping me to believe in myself, and of course, for never being worried. This would not have been possible without you. Thank you to my sister, Melody Wilson, for being an excellent proof-reader and more importantly, for always being my cheerleader. Finally, I would like to thank my fiancé, Charles Fields, who has been there for me at every step of this journey. Your love, support, and wisdom have made this not only possible, but also worth it.

General Introduction

The present thesis is comprised of three articles that describe the findings of a study investigating the role of pathological doubt in bulimia nervosa (BN). To begin, the rationale and empirical basis for examining this construct in BN will be introduced. Pathological doubt is a cognitive construct elicited by inferential confusion, a reasoning process whereby the senses are distrusted and undue importance is attributed to possibility-based information generated by the imagination. The empirical support establishing inferential confusion as an important cognitive feature of obsessive compulsive disorder (OCD; O'Connor, Aardema, & Pélissier, 2005a) as well as the indicators suggesting its relevance in BN will be presented. Furthermore, high rates of comorbidity and similarities in phenomenology also suggest the potential existence of a transdiagnostic cognitive factor, such as pathological doubt, common to both OCD and BN. Overall, the present thesis aimed to determine the applicability of inferential confusion to BN and to evaluate the effects of this cognitive process on BN symptomatology. As such, each component of inferential confusion was measured in a BN sample. The study aimed to 1) investigate maladaptive inductive reasoning processes characterized by over-investment in possibility-based information and to 2) evaluate distrust of sensory information.

Bulimia nervosa (BN)

BN is a severe mental health disorder characterized by recurrent binge episodes and the use of compensatory behaviours. A binge episode is defined as eating a quantity of food exceeding what most people would consume in a comparable period of time, while experiencing a sense of loss of control. Compensatory behaviours often occur subsequent to a binge episode, but can also occur at other times. Vomiting, laxative use, and driven exercise

are examples of compensatory behaviours. Another defining feature of BN is the significant influence of weight and/or shape on the way the self is viewed. These criteria reflect those presented in the fifth edition of the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association [APA], 2013), in which the required frequency for binge episodes was lowered to once per week, as compared to the minimum of two episodes stipulated in previous editions. Preliminary research has supported the validity of the modified criteria and has demonstrated that there is little clinical difference between those diagnosed with BN using current (DSM-5) or previous (DSM-IV-TR; APA, 2000) diagnostic criteria (MacDonald, McFarlane, & Olmsted, 2014).

The lifetime prevalence of BN is approximately 2.6% for women (Stice, Marti, & Rohde, 2013) and the gender ratio is estimated to be 3:1 when comparing women and men (Hudson, Hiripi, Pope, & Kessler, 2007). BN has been associated with increased rates of mortality and suicide (Smink, van Hoeken, & Hoek, 2013) as well as severe medical complications (see Mehler, Birmingham, Crow, & Jahraus, 2010, for a review). Though younger females with a history of physical or sexual abuse are at particular risk, eating disorders (EDs) like BN affect people from all ethnicities and socioeconomic classes (Mitchison & Hay, 2014). BN can also be quite costly in terms of use of health care resources as well as socially, occupationally, and economically (for a review, see Simon, Schmidt, & Pilling, 2005). Though effective and empirically-supported treatments exist for EDs (Hay, Bacaltchuk, Stefano, & Kashyap, 2009), BN can be chronic and the course of the illness lifelong (Ben-Tovim et al., 2001; Keel, Gravener, Joiner, & Haedt, 2010; Smink et al., 2013). Furthermore, a recent study evaluating the treatment of choice for EDs, enhanced cognitive behavioural therapy for EDs (CBT-E; Fairburn, 2008), reported a 44.1% dropout rate and a

31% remission rate for those who completed treatment; these rates are comparable to other studies evaluating treatment efficacy in EDs (see Turner, Marshall, Stopa, & Waller, 2015 for a discussion). This calls for continued research regarding the nature of BN and modifications made to our current conceptualization of this disorder (Mitchell, Agras, & Wonderlich, 2007).

Relationship with obsessive compulsive disorder

OCD is characterized by obsessions (intrusive thoughts/images/impulses) and/or compulsions (repetitive behaviours designed to reduce anxiety/discomfort; APA, 2013). Clinically speaking, there is marked similarity between the symptoms observed in BN and those seen in OCD. The preoccupation with food, weight, and shape in BN has been likened to obsessions in OCD (Pigott et al., 1991) in that both represent repetitive and intrusive thoughts. Compensatory behaviours are also similar to compulsions (Formea & Burns, 1995) as they are performed in reaction to an action (ex: a binge episode), or a thought, and/or to reduce anxiety or distress. In addition to these symptom similarities, a high rate of comorbidity and shared phenomenological features have led some authors to suggest that BN is best defined as existing on the OCD spectrum (Bartz & Hollander, 2006; Treasure, 2006).

Comorbidity. The lifetime prevalence of OCD in individuals with BN is estimated to be between 0 and 42.9% (see Godart, Flament, Perdereau, & Jeammet, 2002 for a review). Though there is significant variability in the rate of comorbidity between these disorders, the majority of studies have consistently demonstrated that OCD is more prevalent in EDs than in the general population and research suggests that both AN and BN are comorbid with OCD at comparable rates (ex: Kaye et al., 2004). It has been demonstrated that this high rate of comorbidity is not due to chance or sampling bias (Altman & Shankman, 2009). Furthermore, EDs (Bienvenu et al., 2000) and specifically BN (Lilenfeld et al., 1998) have been found to be

more prevalent in individuals with OCD as well as in their first-degree relatives. The presence of OCD has been found to have a negative impact on the severity and prognosis of BN (Albert al., 2001; Sallet et al., 2010; Thiel, Broocks, Ohlmeier, Jacoby, & Schussler, 1995), and symptoms of OCD may persist long after the BN has remitted (von Ranson, Kaye, Weltzin, Rao, & Matsunaga, 1999). In addition to the elevated rate of BN with comorbid OCD, studies have also shown that BN is often associated with obsessive-compulsive symptoms even when not meeting full criteria for OCD (Rubenstein, Altemus, Pigott, Hess, & Murphy, 1995). For a review of comorbidity in OCD and EDs, see Bertrand, Bélanger, & O'Connor, 2011.

Shared clinical and cognitive features. The elevated rates of comorbidity between BN and OCD hint that there may be shared clinical and cognitive factors at play. It is important to move beyond their association and investigate what features, if any, are common to both disorders. The identification of factors underlying the relationship between BN and OCD may lead to a better understanding of the central processes and mechanisms responsible for the development and maintenance of these disorders (Altman & Shankman, 2009). In particular, the identification of transdiagnostic features is important as it allows for the refinement of conceptualizations of individual disorders as well as a better understanding of their relationship with one another including their comorbid presentation. Several shared clinical features have already been identified in the literature providing strong evidence for the relationship between OCD and BN. Anxiety has been found to play a significant role in the development, and especially the maintenance, of OCD and BN. Fear of weight gain and fear of negative evaluation are examples of how anxiety is manifested in BN (for a review see Bulik, 1995). It has been found that individuals with EDs have levels of perfectionism comparable to those with OCD and that are significantly higher than those observed in healthy

control (HC) participants (Boisseau, Thompson-Brenner, Pratt, Farchione, & Barlow, 2013). Also, the perfectionism subscale of the Obsessive Beliefs Questionnaire (Obsessive Compulsive Cognitions Working Group, 2001) has been demonstrated to be an important link between ED and OCD symptoms in an undergraduate sample (Humphreys, Clopton, & Reich, 2007). Furthermore, Bernert and colleagues (2013) found that perfectionism mediated the relationship between bulimic and obsessive-compulsive symptoms in a large sample of women with BN. Impulsivity has also been found to be elevated in individuals with BN and with OCD as compared to HC participants on neuropsychological and self-report measures (Boisseau et al., 2012; Engel et al., 2005; Summerfeldt, Hood, Antony, Richter, & Swinson, 2004). Importantly, it has been suggested that BN and OCD have a shared etiology, and that perfectionism and impulsivity contribute to this relationship (Altman & Shankman, 2009). Another domain which has been studied in the relationship between BN and OCD is thought fusion. Thought-action fusion, the belief that having a thought is as bad as carrying out the action in reality, or the belief that having a thought increases the likelihood that it will happen, is a concept that has been adapted from the OCD literature and applied to EDs (Shafran, Teachman, Kerry, & Rachman, 1999). ED-specific thought-fusion, known as thought-shape fusion, includes the belief that merely thinking of a high-calorie food is equivalent to actually eating it and that thinking of eating can result in weight gain. Thought-shape fusion has been demonstrated to be a relevant construct in individuals with EDs (Coelho, Baeyens, Purdon, Pitet, & Bouvard, 2012; Shafran & Robinson, 2004; Shafran et al., 1999). Attentional biases have also been identified in both disorders (Aspen, Darcy, & Lock, 2013; Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005). For example, an attentional bias was documented during a mirror task in which individuals with EDs attended more to body parts

with which they were dissatisfied (Tuschen-Caffier et al., 2015). Finally, over-valued ideation has been linked to both EDs and OCD (Abramowitz, Taylor, & Kay, 2005; Steinglass, Eisen, Attia, Mayer, & Walsh, 2007). In OCD, the degree of insight into obsessions is said to be modulated by over-valued ideation, that is, the degree of conviction in a belief (Neziroglu, McKay, Yaryura-Tobias, Stevens, & Todaro, 1999). In BN, the over-evaluation of eating, shape, and weight was originally characterized as an over-valued idea (Russell, 1983). The degree of over-valued ideation is moderated by level of ego-syntonicity, the degree to which a thought is in line with the values of the individual, where ego-syntonicity is associated with greater over-valued ideation. This relationship is observed in both OCD and EDs (see Purcell Lalonde, O'Connor, Aardema, & Coelho, 2015 for a discussion).

Doubt in OCD and BN. Pathological doubt represents another cognitive factor that is potentially relevant to both OCD and BN. OCD is consistently associated with doubt and is aptly known as the 'doubting disease' (Janet, 1903). Utilising self-report measures designed for the evaluation of OCD, several studies have found associations between doubt and EDs. For example, it was found that the doubting subscale of the Maudsley Obsessive Compulsive Inventory (Hodgson & Rachman, 1977) was the only subscale that distinguished a transdiagnostic ED group from a psychiatric control group (Cassidy, Allsopp, & Williams, 1999). Higher levels of doubt on this scale have also been associated with poorer outcome in BN (Fahy, 1991). In investigations of perfectionism, it has also been found that participants with EDs score higher than HC groups on the 'doubts about actions' subscale of the Multidimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990) (Bastiani, Rao, Weltzin, & Kaye, 1995; Bulik et al., 2003). Elevated scores on the 'doubts about actions' subscale of this measure have been associated with greater ED symptoms in an analogue

sample of EDs (Donovan, Chew, & Penny, 2014). Other research has found "self-doubt" (i.e., lack of self-confidence) and "self-uncertainty" (i.e., poor self-concept) to be part of the personality structure of people with EDs (Goldner, Srikameswaran, Schroeder, Livesley, & Birmingham, 1999; von Lojewski & Abraham, 2014). Furthermore, it has been observed clinically that body image disturbance, a disturbance in the way one's body weight or shape is experienced (APA, 2013), is fundamentally similar to doubt in OCD (Rubenstein et al., 1995). This common feature of EDs has been found to fluctuate across different types of situations (Cash, 2002; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002; Melnyk, Cash, & Janda, 2004; Rudiger, Cash, Roehrig, & Thompson, 2007; Tiggeman, 2001). Social or body-focused situations (Tiggeman, 2001), recent food intake (Vocks, Legenbauer, & Heil, 2007), thoughts about eating high-calorie food (Fett, Lattimore, Roefs, Geschwind, & Jansen, 2009), emotional experiences, and interpersonal awareness (Espeset, Gulliksen, Nordbo, Skarderud, & Holte, 2012) have been found to trigger body image disturbance. It is possible that doubt specific to certain disorder-relevant contexts is at least partly responsible for body image disturbance and its fluctuation (see Espeset et al., 2012).

The inference based approach: A model of doubt in OCD

Given the high rate of comorbidity and the phenomenological similarities between OCD and BN, pathological doubt, as a central construct in OCD, warrants further exploration in BN. A cognitive model termed the inference based approach (IBA) attributes a central and foundational role to doubt in OCD. In this model, doubt is elicited by inferential confusion, a type of faulty reasoning comprised of two interrelated components: 1) distrust of the senses and 2) over-investment in possibility-based information (see Figure 1). Inferential confusion leads the individual to disregard sensory information (ex: 'I see that my hands are clean') and

instead to invest in imagined possibilities (ex: ‘Maybe there are germs on my hands that I cannot see’).

The IBA model views obsessions as inferences about reality arrived at through an inductive narrative that is characterized by inferential confusion (O'Connor, 2002). This narrative is triggered by a percept (i.e., internal or external stimuli), which at the expense of sensory information, leads to the primary doubting inference (ex: ‘Maybe my hands are dirty’) generated by the imagination. The primary doubting inference is followed by a secondary inference about the possible consequences if this state of affairs is true (ex: ‘If my hands are dirty, I could contaminate others’). The narrative leads someone to act as if the primary doubting inference were true, that is, engage in a compulsion (ex: wash their hands). These elements form a subjective narrative based on imagination that illustrates how obsessional doubt develops and is maintained in OCD (O’Connor et al., 2005a).

There is strong empirical support for the IBA model as well as for the efficacy of inference based therapy (IBT) in OCD (see Julien, O’Connor, & Aardema, 2016 for a review). Furthermore, inferential confusion has been found to be a predictor of OCD symptoms (Aardema, Radomsky, O'Connor, & Julien, 2008) and to account for an important part of the relationship between obsessive beliefs and OCD symptoms (Aardema, O'Connor, & Emmelkamp, 2006). These findings lend support to the idea that inferential confusion is an important feature of OCD. Pathological doubt and the applicability of IBA has been investigated in the context of several other psychological disorders, namely, hoarding disorder, delusional disorder, body dysmorphic disorder, as well as EDs. Though there is less research into the role of doubt in these other disorders than in OCD, it has been suggested that doubt is transdiagnostic and warrants continued investigation in these domains (for a review, see

O'Connor, Aardema, & Ouellet-Courtois, in press). The present text will specifically focus on the applicability of this model to BN.

The inference based approach: A model of doubt in BN

As stated above, BN can also be conceptualized in terms of IBA. In the IBA model, an individual with BN may have a thought such as 'Maybe I've gained weight' (primary doubting inference) upon exposure to a relevant percept (ex: their body). This leads to thoughts about the potential consequences if this were true, for example, 'If I've gained weight, I will be rejected by others' (secondary doubting inference; see Figure 2). These thoughts are examples of possibility-based information generated by the imagination. Despite contradictory reality-based information (ex: weight and shape have not changed, clothes still fit the same, etc.), undue importance is attributed to these possibilities. As a result of this reasoning style, the individual feels compelled to act as if the primary doubting inference were true and to engage in dietary restriction or compensatory behaviours (for a discussion, see Purcell Lalonde & O'Connor, 2012). It is important to note that these inferences are not based on sensory information, and in fact may even contradict the senses (ex: 'I can see my ribs in the mirror, but what if others think I'm fat and reject me'). As the doubt is based on imaginary information, no matter how much weight the person loses or how many times they check their body the doubt will never be resolved. The senses (i.e., reality-based information) will continue to be distrusted in favour of the imagination (i.e., possibility-based information), maintaining the disorder over time (O'Connor et al., 2005a).

The standard conceptualization of BN and other EDs is outlined by the transdiagnostic model of EDs (Fairburn, Cooper, & Shafran, 2003). According to this model, three core mechanisms interact with one another. It is theorized that the over-evaluation of eating, shape,

and weight results in dietary restriction, which in turn leads to binge eating and the use of compensatory behaviours (Fairburn et al., 2003). The over-evaluation of eating, shape, and weight is termed the core psychopathology of BN. Though several maintenance factors are proposed in the transdiagnostic model (clinical perfectionism, core low self-esteem, mood intolerance, and interpersonal problems), it remains unclear how the intense preoccupation with eating, shape, and weight develops. As described above, ED-specific preoccupations are similar to obsessions in OCD. It is possible that these preoccupations develop in the same way as obsessions, that is, via faulty inductive reasoning. The IBA model may add to the standard conceptualization of BN through a better understanding of how the preoccupation with eating, shape, and weight is initiated.

In light of the commonalities between BN and OCD, IBT has been adapted for EDs (Bertrand & O'Connor, 2009). A recent treatment outcome study employing a BN sample found that IBT led to clinically significant improvement in ED symptoms (Purcell Lalonde & O'Connor, 2015; Purcell Lalonde, O'Connor, St-Pierre-Delorme, Perreault, & Wilson, 2016). The efficacy of IBT points to the importance of exploring inferential confusion and its components in BN.

Inferential confusion: Over-investment in possibility-based information

As stated previously, the over-investment in possibility-based information is one of the components of inferential confusion, a faulty inductive reasoning process. In the IBA model, it is postulated that individuals with OCD and other disorders characterized by high inferential confusion over-invest in possibilities generated by the imagination during inductive reasoning.

Reasoning in OCD. Early research into reasoning processes found evidence for impairments in probabilistic reasoning in OCD. The Beads Task is often used to assess this

form of reasoning. In this measure of probabilistic reasoning, two jars filled with beads are presented to participants. It is explained that they have different ratios of different coloured beads (ex: one jar has 85 red and 15 green, while the other has the inverse ratio). The experimenter then draws beads from one of the jars until the participant feels they have enough information to conclude which jar the experimenter is using (Huq, Garety, & Hemsley, 1988). Using different forms of the Beads Task, it has been demonstrated that individuals with OCD require more information before being able to make a decision or to draw a conclusion; this is also known as an excessive evidence gathering style (Fear & Healy, 1997; Milner, Beech, & Walker, 1971; Volans, 1976). Probabilistic reasoning tasks also involve inductive reasoning as conclusions are not only formed on the basis of the information presented (i.e., the beads drawn), but also on pre-existing knowledge (i.e., an understanding of the principles of probability; Pélissier, O'Connor, & Dupuis, 2009). In contrast to deductive reasoning, in which a conclusion is based on the premises provided, inductive reasoning is defined by the addition of new information, from one's imagination or based on past experience, to the premises. Using general measures of reasoning, Pélissier and O'Connor (2002) found that inductive (but not deductive) reasoning was impaired in OCD. Specifically, the authors found evidence that the OCD group had greater facility in generating alternatives and possibilities on measures of inductive reasoning. Furthermore, it was determined that the consideration of alternatives decreased conviction in a given statement (or put another way, increased doubt), and that the magnitude of the decrease was related to OCD symptom severity (Pélissier & O'Connor, 2002). These findings are in line with the IBA model and point to the role of inferential confusion in OCD in that they suggest that people with OCD produce too many possibilities during everyday inductive reasoning, thereby eliciting doubt. To explore this

hypothesis further, a novel inductive reasoning task based on an unpublished probabilistic inference task (Johnson-Laird, 1994), known as the Reasoning with Inductive Arguments Task (RIAT; Pélissier, O'Connor, & Dupuis, 2009) was created. This inductive reasoning task operationalizes doubt as the change in confidence in an initial conclusion following the presentation of alternatives. Pélissier and colleagues (2009) found individuals with OCD evinced greater levels of doubt, and thus demonstrated a maladaptive inductive reasoning style, as compared to HC participants when the alternative conclusions were provided by the experimenter. This supports the notion that people with OCD attribute undue importance to outside sources (ex: reassurance seeking) and/or rules (ex: having to count to a certain number to avoid a negative consequence) rather than trusting their senses (O'Connor et al., 2005a). It is important to note that the OCD group did not generate more alternatives than the HC group, and so the results seem to be due to the attribution of more importance to the alternatives in the case of the OCD group. Also, there were no group differences in initial level of confidence in the first conclusion given. As such, it does not seem to be that the OCD group was less confident in their reasoning or conclusion drawing abilities from the start, but rather that the consideration of alternatives elicited doubt in the OCD group, more than in the HC group. This pattern of results was found for OCD-relevant and neutral items, indicating that anxiety was not responsible for the results obtained (Pélissier et al., 2009). Furthermore, in a study evaluating inductive reasoning using well-established paradigms, it was found that people with OCD performed comparably to HC participants with a notable exception: the OCD group was significantly more doubtful and hesitant than the HC group (Simpson, Cove, Fineberg, Msetfi, & Ball, 2007). Building on these studies employing formal measures of inductive reasoning, Aardema, O'Connor, Pélissier, and Lavoie (2009) developed the Inference Processes Task

(IPT) as an analogue of obsessional doubt in order to better explore this process using clinically salient material. In this task, participants are presented with a scenario followed by alternating pieces of reality-based and possibility-based information. The IPT measures doubt as an ongoing and dynamic process, as opposed to a static one, which contributes to its ecological validity. Using this task, it was found that people with OCD consider reality-based information in a way that is comparable to HC participants, however, they seem to attribute far more importance to possibility-based information, which leads to higher levels of doubt (Aardema et al., 2009). It was also found that baseline levels of inferential confusion may help to explain the observed effect of possibility-based information on the OCD group (Aardema et al., 2009). These findings have been replicated in OCD (Nikodijevic, Moulding, Anglim, Aardema, & Nedeljkovic, 2015). The problematic role of the imagination and possibility-based information in OCD has also been supported by studies using other measures. For example, a study that asked participants to simulate how a scenario may have led to an outcome in a step-by-step fashion, found that individuals with OCD found it easier to simulate what may have happened and believed the scenario to be more probable when the content was related to their obsessive fears (Keen, Brown, & Wheatley, 2008). Relatedly, other research has found that perseverative reasoning (step-by-step reasoning) increases feelings of uncertainty while also increasing credibility in an unlikely negative outcome (Giele, van den Hout, Engelhard, Dek, & Hofmeijer, 2011). These findings highlight abnormalities in reasoning that may be related to over-investment in possibility-based information.

Reasoning in BN. In a theoretical model of schematic content and processing in EDs, Vitousek and Hollon (1990) proposed a link between information processing deficits related to the overuse of weight and shape-related schemas and reasoning errors in this population. More

recently, it was theorized that confirmation bias, a type of reasoning error, is implicated in body checking in that individuals who engage in this behaviour may do so to confirm negative beliefs about the self (Aspen et al., 2013). To our knowledge, however, only a single study has empirically evaluated reasoning in EDs. Sternheim, Startup, and Schmidt (2011) administered the Beads Task (Huq et al., 1988) to compare probabilistic reasoning in anorexia nervosa (AN), BN, and HC participants. The authors found that participants with BN requested that significantly more beads be drawn than AN or HC participants. This study provides evidence for an excessive evidence gathering style in BN similar to that observed in OCD. The authors attribute this pattern of results group to the finding that those with BN were also less certain and less confident than the other two groups (Sternheim et al., 2011). Though uncertainty and lack of confidence are possible explanations, an alternative is that these findings can be related to doubt due to inferential confusion. Indeed, doubt and uncertainty are distinct constructs. Doubt is uncertainty despite access to reality-based information, while uncertainty occurs in relation to circumstances about which one does not yet have information. As has been found in OCD, impairments on the Beads Task may also hint at impaired inductive reasoning characterized by over-investment in possibility-based information in BN.

Feared possible selves in OCD and in BN. Another manifestation of the over-investment in possibility-based information is the over-investment in feared possible selves (ex: 'I might be dangerous'; 'I might become overweight'). Self-concept is recognized to play a potentially important role in the development and maintenance of OCD symptomatology. For example, it has been suggested that insecure self-views are related to the importance attributed to intrusive thoughts (Bhar & Kyrios, 2007) and there is evidence to suggest that ego-dystonic intrusions are more likely to be misappraised as negative (Purdon & Clark, 1999;

Clark, 2004, Purdon, Cripps, Faull, Joseph, & Rowa, 2007). Furthermore, it has been demonstrated that individuals with OCD make negative inferences about themselves on the basis of their own intrusions (Ferrier & Brewin, 2005) and believe these thoughts are revelatory about their true self (Aardema & O'Connor, 2007; Riskind, Ayers, & Wright, 2007). It has also been determined that vulnerable or sensitive self-themes, defined as domains that are valued, but in which the individual lacks confidence or feels incompetent, play a role in the development of specific intrusive thoughts (Doron & Kyrios, 2005; Doron et al., 2007). In addition to the content of self-concept, it has been proposed that individuals with OCD attribute greater importance to the 'self-as-could-be' (the possible self) than to the 'self-as-is' (the current, reality-based self), which is contrary to the experience of self of individuals without OCD (Aardema & O'Connor, 2007). Given the threatening nature of obsessions, a concept termed the 'fear of self' has been studied in OCD. Fear of self refers to qualities or characteristics (ex: being overweight, unlovable, undisciplined, etc.) a person fears they may possess (Markus & Nurius, 1986). Fear of self has been associated with OCD symptoms in analogue and clinical samples (Aardema et al., 2013; Melli, Aardema, & Moulding, 2016; Nikodijevic et al., 2015). Finally, fear of self, essentially investment in a feared possible self, has been identified as a predictor of the over-investment in possibility-based information (Nikodijevic et al., 2015), highlighting the relationship between these constructs.

Furthermore, research into self-concept may help to elucidate the idiosyncratic content of obsessions as they differ across individuals with OCD and EDs. The traditional cognitive-appraisal model of OCD postulates that obsessions arise when normal intrusive thoughts are misappraised (ex: 'If I thought about pushing someone, it means I am dangerous'). The IBA model focuses more closely on the beginning of the sequence and argues that thoughts become

obsessional even before they are misappraised, that is, when possibility-based information takes precedence over the senses. Regardless of the conceptual model used to understand how obsessions develop, it remains unclear why one person with OCD may have obsessions related to possible dangerous impulses, while another fears contamination. Research consistent with IBA has increasingly aimed to better understand the thoughts that initiate the obsessional sequence to help to explain the idiosyncratic content of obsessions, which has led to an exploration of self-concept in OCD (Aardema & O'Connor, 2007; Doron, Kyrios, & Moulding, 2007).

Fear of self may help to explain the obsessional preoccupation with eating, shape, and weight in BN; the content of these preoccupations may represent vulnerable self-themes for those who develop an ED. Similar to research in the area of OCD, it has been found that individuals with EDs have unconditional negative representations of the self (Cooper, 1997; Erikson, Hansson, & Lundblad, 2012; Waller et al., 2003) that are associated with ED symptoms (Waller, Ohanian, Meyer, & Osman, 2000). More specifically, research has demonstrated that individuals with EDs score significantly higher on a measure of the fear of self than HC participants (Purcell Lalonde, O'Connor, Aardema, & Coelho, 2015). Furthermore, a recent study suggests that EDs are associated with greater fear of self than some subtypes of OCD (Aardema et al., 2017). As in OCD, it may be that individuals with BN view their worries (ex: 'I may lose control and over-eat resulting in weight gain') as revealing something about themselves (ex: 'I am the kind of person who will lose control over eating'). Investment in a feared possible self may help to explain why someone at a healthy or low weight is preoccupied with weight gain and acts accordingly (i.e., engaging in dieting and compensatory behaviours). It may be that the self-as-could-be (ex: someone who lacks self-

control, is overweight, etc.), or the feared self, may take precedence over the self-as-is (ex: someone who is disciplined, is a healthy weight, etc.) in the self-construction of the person with BN. If this is the case, it would be an example of the investment in possibility-based information (i.e., in a feared possible self) at the expense of reality-based information.

Inferential confusion: Distrust of the senses

Distrust of the senses is the second component of inferential confusion. It is defined as 'disregarding the senses in favor of going deeper into reality' (O'Connor et al., 2005a). This construct includes low confidence in perceptual abilities (ex: 'I can see that the door is locked, but maybe my eyes are playing tricks on me'), a subtype of cognitive confidence which has received a lot of research attention in OCD (see Hermans et al., 2008 for a discussion). Low cognitive confidence encourages the reliance on possibility-based information, contributing to the development of doubt. There is also some evidence to support its association with EDs (see O'Connor et al., in press for a discussion). Distrust of the senses also includes a tendency to go beyond the senses either into imagination or into a past reality (i.e., the senses are trusted, but the sensory information is not considered satisfactory). As the obsessional doubt goes beyond the senses, any attempt to resolve this doubt in reality (i.e., through compulsive behaviours) will be unsatisfactory, that is, no matter how many times the door is checked, the imagination will continue to conjure reasons why it may not be locked (O'Connor & Robillard, 1995). This underlines the unavoidable interrelatedness of the components of inferential confusion (a person distrusts the senses in favour of investing in possibility-based [or imagination-based] information) and how each component contributes to the construction of the obsessional narrative.

The belief held by those with EDs that they are overweight despite being very thin has long puzzled clinicians and researchers (Aragona & Vella, 1998). Body image disturbance may be an example of inferential confusion in this population (ex: 'I can see my ribs in the mirror, but what if my eyes are playing tricks on me, or what if I become overweight in the future'). Most research seeking to address the question of body image disturbance in EDs has focused on perceptual deficits in this population. A review on the subject concluded, however, that it was unlikely that individuals with EDs have a generalized sensory-perceptual deficit (Cash & Deagle, 1997). As such, there has been a recent call to investigate cognitive factors underlying body image disturbance (Frank & Treasure, 2016). Several cognitive factors have already been identified as underlying body image disturbance such as thought-shape fusion (Shafran & Robinson, 2004), self-ideal discrepancy, and body dissatisfaction (Hagman et al., 2015; Frank & Treasure, 2016). Another potentially relevant cognitive factor is pathological doubt maintained by distrust of the senses. There is evidence to suggest that doubt plays a role in body image disturbance during body estimation tasks. For example, a study utilizing three different measures of body perception in a non-clinical sample found no indication of body size over- or under-estimation, but concluded instead that the restrained eaters were more uncertain about their body size than the unrestrained eaters (Lautenbacher et al., 1992). A more recent qualitative study in AN found that uncertainty and/or doubt regarding one's appearance was a higher order factor underlying fluctuations in the experience of body image elicited by different body-relevant contexts (Espeset et al., 2012).

As in OCD, individuals with EDs have been found to engage in different behaviours, such as body checking, in an attempt to resolve doubt related to the body. Body checking is a common clinical behaviour that is conceptually similar to compulsive checking as observed in

OCD. Furthermore, some research suggests that body checking may be more prevalent in BN than in other EDs (Kachani, Barroso, Brasiliano, Hochgraf, & Cordas, 2014). Examples of body checking behaviours include frequent weighing, examining oneself in the mirror, pinching 'fat', seeking reassurance about one's body, comparing one's body to others' bodies, and using clothes to check for tightness (Rosen, 1997). In OCD, the pathological doubt characteristic of compulsive checking was originally hypothesized to be due to various deficits (mnestic, perceptual, etc.). As in EDs, there were mixed findings related to the existence of specific deficits in OCD (for a review, see Woods, Vevea, Chambless, & Bayen, 2001). In light of these inconsistencies, the role of cognitive confidence was examined in OCD. Most relevant to EDs are studies pertaining to perception and attention, which determined that these functions were not impaired, but rather found that individuals with OCD as well as analogue samples of OCD had low confidence in their perceptual and attentional abilities (Hermans et al., 2008; van den Hout et al., 2008; 2009). Furthermore, it has been found that low cognitive confidence in OCD may be maintained by the cycle of repeated checking, whereby a person checks because they are unsure, but paradoxically the checking then leads to increases in the levels of doubt and uncertainty resulting in more checking (Radomsky, Gilchrist, & Dussault, 2006; van den Hout & Kindt, 2003; 2004).

A similar paradoxical relationship has been noted in EDs. There is evidence to suggest that body checking behaviours initially provide reassurance, but ultimately increase distress in the long-term (see Meyer, McPartlan, Rawlinson, Bunting, & Waller, 2011 for a discussion). Research into beliefs about body checking suggests that individuals who engage in these behaviours believe that body checking helps to maintain control over eating, shape, and weight, but also believe that failing to body check can result in the feared outcome (i.e.,

gaining weight; Mountford, Haase, & Waller, 2006). Moreover, it has been found that body checking leads to increased body dissatisfaction, self-critical thoughts, fear of fatness, and weight and shape concerns (Shafran, Fairburn, Robinson, & Lask, 2004; Shafran, Lee, Payne, & Fairburn, 2007). Finally, body checking is considered to be a behavioural manifestation of the over-evaluation of eating, shape, and weight (Shafran et al., 2004) that also seems to maintain these preoccupations (Williamson, Muller, Reas, & Thaw, 1999) as well as body image disturbance (Reas, Whisenhunt, Netemeyer, & Williamson, 2002).

Doubt due to inferential confusion would help to explain the paradoxical relationship between body checking and increases in ED symptoms. If more importance is attributed to the possibility that they may be over-weight than to the reality-based information perceived with their senses during body checking, then it would not be surprising that someone with BN would act as if they are overweight and engage in pathological ED behaviours. These findings suggest that inferential confusion may be an important feature of BN in that perseverative body checking may elicit distrust in the senses, helping to explain resultant increases in distress and ED symptoms. Taken together, research into body checking suggests that low perceptual confidence, a feature of distrust of the senses, may be a relevant cognitive factor in EDs. Furthermore, several studies using a general self-report measure found that individuals with EDs reported lower cognitive confidence than HC groups (Cooper, Grocutt, Deepak, & Bailey, 2007; Davenport, Rushford, Soon, & McDermott, 2015; McDermott & Rushford, 2011; Olstad, Solem, Hjemdal, & Hagen, 2015; Vann, Strodl, & Anderson, 2014), with one study also finding a significant correlation between low cognitive confidence and ED symptom severity (Olstad et al., 2015). A single study employing an analogue sample found no difference in cognitive confidence between those with and without problematic eating

attitudes (Konstantellou & Reynolds, 2010). To our knowledge, ED-specific or experimental measures have not yet been utilised in the examination of cognitive confidence or its subtypes (i.e., perceptual confidence) in EDs.

Aims of thesis

The present thesis aimed to examine the applicability of inferential confusion, a cognitive process found to be central in OCD, to BN. The two components of inferential confusion, over-investment in possibility-based information and distrust of the senses, as well as their impact on BN symptomatology, were investigated. The decision to employ a sample with BN, as opposed to AN, was based on the consideration of several factors. Notably, use of a BN sample reduces the potential confounding effect of malnutrition on reasoning processes. Furthermore, rates of comorbidity between OCD and BN have been found to be similar to rates of comorbidity between OCD and AN (ex: Kaye et al., 2004). Similarities in clinical and cognitive features have also been consistently documented between BN and OCD (as reviewed above).

The first part of the present study aimed to evaluate the influence of possibility-based information on inductive reasoning in BN. This part of the study also aimed to replicate previous findings pertaining to strong investment in a feared possible self in EDs. The RIAT and the IPT (see Appendix D), measures of faulty inductive reasoning operationalized as doubt, were administered in an online survey format along with questionnaires assessing fear of self and BN symptom severity (see Appendix E). An examination of the over-investment in possibility-based information in BN will contribute toward a more refined understanding of reasoning processes in this population and their role in the development and maintenance of beliefs and behaviours consistent with BN.

The second part of the study aimed to evaluate distrust of the senses in BN. This was accomplished through the use of a body checking task designed to elicit low perceptual confidence, a form of distrust of the senses, through prolonged checking (see protocol and visual analogue scales in Appendix C). This was done to experimentally test the paradoxical relationship between confidence and checking that is consistently observed in OCD in BN. A novel measure of distrust of the senses with BN-specific content (see Appendix E) and a measure of habitual body checking were also administered online. This investigation will provide insight into body checking and its relationship to BN symptomatology as well as potentially highlight the relevance of addressing cognitive confidence when targeting this behaviour in treatment.

This study received ethical approval from the Research Ethics Board at the Institut universitaire en santé mentale de Montréal (see Appendix A). The consent form is provided in Appendix B. Fifty-one women (BN: $n = 26$; HC: $n = 25$) participated in both parts of the study. Reasoning tasks and self-report questionnaires were completed online. Diagnostic evaluations and the body checking task were completed in the laboratory. See Figure 3 for participant flow through the study.

Hypotheses. With regards to the over-reliance on possibility-based information, it was hypothesized that 1) BN would be associated with a maladaptive inductive reasoning style whereby undue importance is attributed to possibility, 2) BN would also be associated with increased fear of the possible self, and 3) severity of BN symptoms and body dissatisfaction would be associated with higher levels of over-investment in possibility-based information as described in 1) and 2). With regards to distrust of the senses, it was hypothesized that 1) body checking would result in decreased perceptual confidence, 2) greater decreases in perceptual

confidence would be associated with body dissatisfaction and BN symptoms, and 3) habitual body checking would be associated with distrust of the senses.

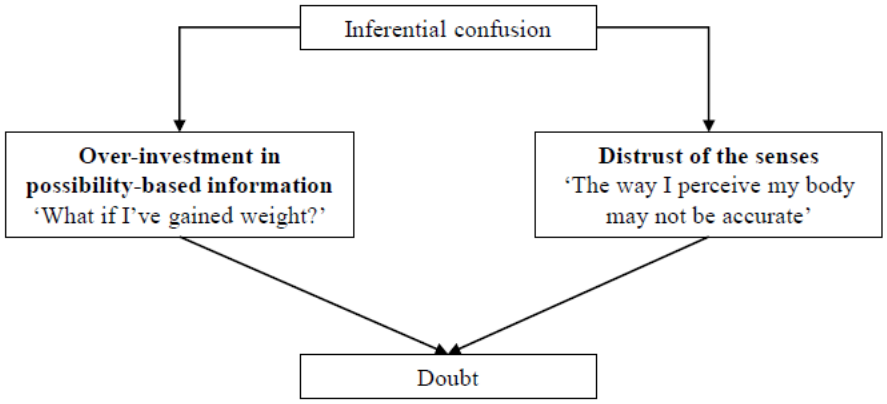

Figure 1. A graphical depiction of the components of inferential confusion and their relationship with doubt using an eating disorders-specific example.

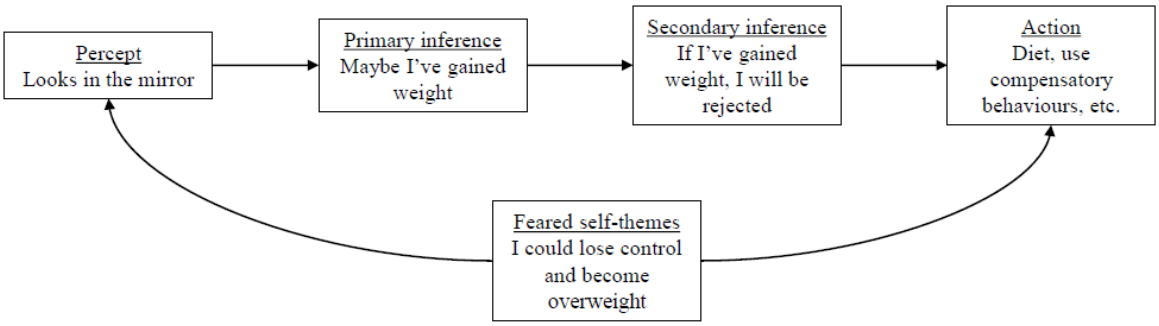

Figure 2. An example of an inference-based approach conceptualization of eating disorders demonstrating the creation of a faulty inductive narrative.

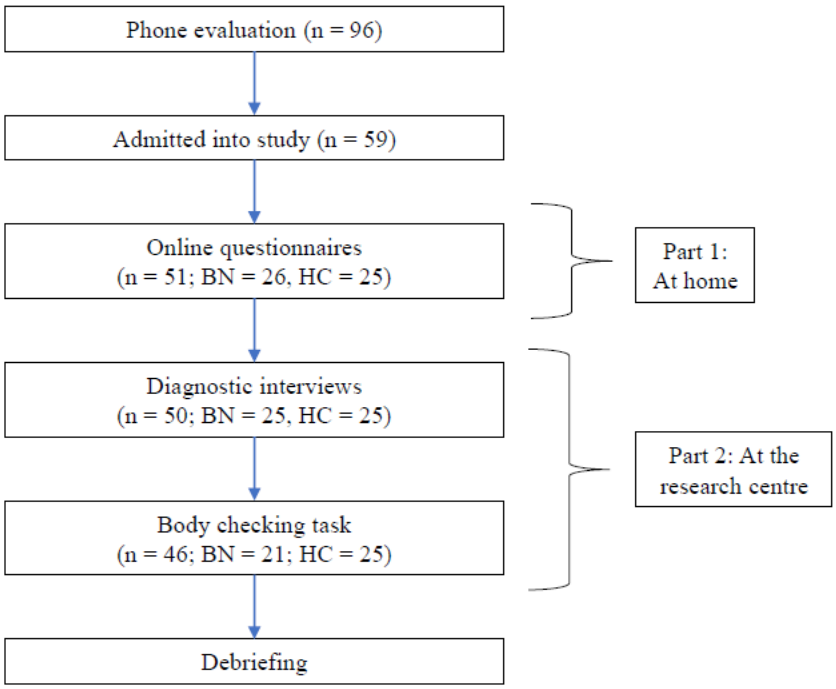

Figure 3. The flow of participants through the study.

Article 1: Possibility-based information elicits doubt in bulimia nervosa: A study of inductive reasoning[1]

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This work was supported by the Fonds de Recherche du Québec – Santé [#33663] and by the Canadian Institutes of Health Research [#114905]. The authors would also like to acknowledge the statistical support provided by Charles-Édouard Giguère, MSc.

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[1] This manuscript was submitted for publication in the *International Journal of Cognitive Therapy*.

Abstract

Several theoretical accounts suggest the relevance of reasoning processes in eating disorders (EDs), but empirical studies in this area have been limited. Faulty inductive reasoning characterized by doubt has previously been demonstrated in obsessive compulsive disorder (OCD), a disorder that is highly comorbid and shares several cognitive processes with EDs. In particular, a reasoning process termed inferential confusion has been found to elicit doubt and lead to faulty inductive reasoning via an over-investment in possibility-based information. Participants with bulimia nervosa (BN; n = 25) and healthy controls (HC; n = 24) completed a self-report measure of inferential confusion as well as the experimental Reasoning with Inductive Arguments Task (RIAT). The BN group demonstrated greater levels of inferential confusion as compared to the HC group. On the RIAT, BN group confidence was more impacted by possibility-based information than the HC group. These findings suggest the relevance of inferential confusion in BN and its potential impact on inductive reasoning.

Keywords: bulimia nervosa; inductive reasoning; inferential confusion

Possibility-based information elicits doubt in bulimia nervosa: A study of inductive reasoning

More than two decades ago, Vitousek and Hollon (1990) posited a theoretical model of eating disorders (EDs) that suggested the possible relevance of reasoning errors and other information processing deficits in this population and underlined the importance of better understanding the cognitive style of EDs. More recently, the potential clinical relevance of reasoning errors was highlighted by Aspen and colleagues (2013) who suggested that some ED behaviours (ex: body checking) may be performed in an effort to confirm negative beliefs about the self (i.e., confirmation bias). Despite these theoretical accounts on reasoning deficits in EDs, to our knowledge, only a single study has evaluated reasoning in this population. In a study using the Beads Task (Huq, Garety, & Hemsley, 1988), participants with bulimia nervosa (BN) requested significantly more beads be drawn than participants with anorexia nervosa (AN) or healthy controls (HC; Sternheim, Startup, & Schmidt, 2011). This study of probabilistic reasoning suggests an excessive evidence gathering style and may also point to abnormalities in inductive reasoning. Inductive reasoning is present in probabilistic reasoning tasks as they require that a person form a conclusion based on the information presented (i.e., the beads drawn) as well as pre-existing knowledge (i.e., an understanding of the principles of probability; Pélissier, O'Connor, & Dupuis, 2009). Given the potential clinical relevance of reasoning, these processes warrant further examination in EDs.

Reasoning has received substantial research attention in the field of obsessive compulsive disorder (OCD) which may help to inform the investigation of these processes in EDs. There is substantial overlap between EDs and OCD in terms of comorbidity (Godart, Flament, Perdereau, & Jeamment, 2002), symptom similarities (Formea & Burns, 1995; Pigott et al., 1991), and cognitive processes (ex: Shafran, 2002). Reasoning may represent another

relevant domain characterized by similarities between these disorders. In OCD, reasoning processes have been studied extensively. Studies have found support for abnormal probabilistic (Fear & Healy, 1997; Milner, Beech, & Walker, 1971; Volans, 1976), inductive (Aardema, O'Connor, Pélissier, & Lavoie, 2009; Nikodijevic, Moulding, Anglim, Aardema, & Nedeljkovic, 2015; Pélissier & O'Connor, 2002; Pélissier et al., 2009; Simpson, Cove, Fineberg, Msetfi, & Ball, 2007), and step-by-step (Giele, van den Hout, Engelhard, Dek, & Hofmeijer, 2011) reasoning. Deductive reasoning appears to be intact in OCD (Pélissier & O'Connor, 2002; Simpson et al., 2007). This pattern of findings makes sense given the conceptual overlap between probabilistic and inductive reasoning.

Furthermore, several studies have found that uncertainty and doubt are implicated in reasoning in OCD (Aardema et al., 2009; Giele et al., 2011; Nikodijevic et al., 2015; Simpson et al., 2007; Pélissier et al., 2009). There is evidence to suggest that doubt is elicited by a faulty inductive reasoning process termed 'inferential confusion' (O'Connor, Aardema, & Pélissier, 2005), contributing to our understanding of this relationship. Inferential confusion is characterized by the over-investment of possibility-based information (Perhaps X will occur) at the expense of reality-based information (My five senses tell me that X is not likely to occur). Inferential confusion has been consistently associated with OCD (Aardema et al., 2010) and has shown to be a strong predictor of OCD symptoms (Aardema, Radomsky, O'Connor, & Julien, 2008). Interestingly, Sternheim and colleagues (2011) noted that the excessive evidence gathering style observed in BN participants in their study was influenced by a tendency to be less certain/confident in their decisions as compared to the AN or HC groups. Additionally, a study utilising a BN sample found that therapy addressing inferential confusion and doubt was effective in reducing ED symptoms (Purcell Lalonde & O'Connor,

2015). This suggests that uncertainty and doubt may also influence reasoning processes in BN as has been observed in OCD.

The present study aimed to investigate inductive reasoning and doubt in BN using a self-report measure of inferential confusion as well as an experimental reasoning task previously used in OCD samples. Given previous findings pertaining to reasoning in BN (Sternheim et al., 2011), a sample with BN was employed. Recruitment of a BN sample also guards against the potential effect of low weight on reasoning that may be observed in a sample with AN. It was hypothesized that the BN group would report greater inferential confusion than the HC group on a self-report measure of this construct. It was also hypothesized that the BN group would demonstrate abnormal inductive reasoning characterized by inferential confusion, operationalized on a reasoning task as over-investment in possibility-based information.

Method

Participants

Twenty-five women with BN (age: $M = 26.92$; $SD = 8.98$) and 25 HC women (age: $M = 26.13$; $SD = 4.78$) were recruited. One participant in the HC group was found to be a significant outlier on several measures of psychopathology (administered in the context of a larger study) and was excluded from the present analyses, resulting in a total of 24 participants in the final HC group. No differences were found between groups on age $t(36.89) = .39$, $p = .70$, body mass index $t(46) = .82$, $p = .42$, and education level $\chi^2 (5, N = 49) = 1.15$, $p = .95$. Participants were recruited from the community using targeted advertisements (some advertisements were directed at individuals who identified as having BN and some were directed at individuals without eating difficulties) in the context of a larger study. Exclusion

criteria were: evidence of current or past schizophrenia, bipolar or organic mental disorder, presence of traumatic brain injury, the inability to read and/or understand either English or French, and for the HC group, presence of severe psychopathology and presence or history of an ED. Several HC participants were admitted into the study despite reporting mild symptoms of specific phobia (n = 2), panic attacks (n = 2), and generalized anxiety disorder (n = 1) during the phone evaluation in an effort to avoid creating an artificial control group.

Procedure

The present study was approved by the Research Ethics Board at the Montréal Mental Health University Institute. Interested participants were screened over the phone using standard diagnostic questions pertaining to their eating habits, mood, anxiety, psychosis, and substance use to ensure eligibility. The study and important ethical considerations (ex: voluntary participation, confidentiality, etc.) were explained to eligible participants. Participants then received a link to the consent form and online measures, including the RIAT and another reasoning task (described elsewhere, see Wilson, Aardema, & O'Connor, 2017), via email. Following completion of the online portion of the study, an in-person appointment was scheduled at the research centre. Participants were presented with a hard copy of the consent form and the Eating Disorders Examination (EDE; Fairburn & Cooper, 1993) was administered by the experimenter (SW). Financial compensation was offered to all participants.

Measures

The EDE, version 16, (Fairburn et al., 2008) has excellent reliability, discriminant validity, and internal consistency (Fairburn & Cooper, 1993; Rizvi, Peterson, Crow, & Agras, 2000). This semi-structured interview establishes the diagnosis of eating disorders by

evaluating the presence or absence of relevant behavioural (e.g., bingeing, purging, restricting) and cognitive (e.g., over-evaluation of eating, weight, and shape) symptoms. These symptoms are assessed for the preceding 3-month period.

The Inferential Confusion Questionnaire - Expanded Version (ICQ-EV; Aardema et al., 2010) is a 30-item self-report questionnaire measuring the tendency to distrust the senses in favour of possibility-based information (example item: I can get very easily absorbed in remote possibilities that feel as if they are real). Items are rated on a 6-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Internal consistency has been shown to vary between .96 - .97 in non-clinical samples and was found to be .986 in the current sample.

The Reasoning with Inductive Arguments Task (RIAT; Pélissier et al., 2009) is based on a probabilistic inference task developed by Johnson-Laird (1994) and further adapted as a measure of formal inductive reasoning processes in OCD (Pélissier et al., 2009). The content was adapted for BN for the purposes of the present study. In this task, two premises and a conclusion based on these premises are initially presented. Participants are then asked to rate their confidence in the likelihood of the initial conclusion (from 0 - 100% confident). Subsequently, participants are provided with alternative conclusions (i.e., possibility-based information) that are in line with BN pathology (ex: Maybe I gained weight) and that contradict the initial conclusion. Participants are then asked to re-assess their level of confidence in the initial conclusion. This task measures particularities in inductive reasoning style, whereby doubt is operationalized as the degree of change in the level of confidence in the initial conclusion before and after consideration of alternatives (with decreased confidence representing greater doubt). This task has been validated as an analogue of doubt in OCD

(Pélissier et al., 2009). The task was comprised of 18 items, half were BN-relevant and half were neutral. See Table 1 and 2 for example items.

Results

Possibility-Based Information

Repeated measures analysis of variance (ANOVA) was used to assess the effect of the presentation of possibility-based information in the form of alternative conclusions on confidence in an initial conclusion on the RIAT. Group (BN vs. HC) and item type (BN-relevant vs. neutral) were the independent variables. See Table 3 for means and standard deviations. Confidence in the initial conclusion, assessed pre- and post the presentation of alternative conclusions, was the dependent variable.

The omnibus test revealed a significant three-way interaction between group, item type, and time $F(1, 47) = 11.54$, $p = .001$, $\eta_p^2 = .20$. Post hoc analyses of the within subjects effects indicated that confidence in the initial conclusion significantly decreased in the BN group for neutral items following the presentation of alternative conclusions $F(1, 47) = 9.71$, $p = .003$, $\eta_p^2 = .17$. There was no significant change in confidence on the BN-relevant items in the BN group $F(1, 47) = 3.12$, $p = .08$, $\eta_p^2 = .06$. There was no significant change in confidence in the initial conclusion following the presentation of alternative conclusions in the HC group for the neutral $F(1, 47) = .15$, $p = .70$, $\eta_p^2 = .003$ or for the BN-relevant $F(1, 47) = .92$, $p = .34$, $\eta_p^2 = .02$ items. The between subjects effect was also statistically significant $F(1, 47) = 44.20$, $p < .001$, $\eta_p^2 = .46$. Post hoc analyses revealed there was a significant difference between the BN and HC groups with regards to baseline confidence in the initial conclusion for the BN-relevant items $F(1, 47) = 69.04$, $p < .001$, $\eta_p^2 = .60$, with the BN group evincing

lower baseline confidence. There was no baseline difference in confidence between groups for neutral items $F(1, 47) = .27$, $p = .61$, $\eta_p^2 = .006$. See Figure 1 and Figure 2.

In order to examine the potential effect of comorbidity on the results, additional analyses were conducted. The omnibus test revealed that there was no significant interaction between group (BN with comorbid disorders, $n = 14$, and BN without comorbid disorders, $n = 10$), item type, and time $F(1, 22) = .23$, $p = .64$ on the RIAT. There were no differences between groups for BN-relevant items pre $t(22) = -.02$, $p = .99$ or post $t(22) = .47$, $p = .65$ the presentation of alternatives. There were also no group difference for neutral items post the presentation of alternatives $t(22) = -.79$, $p = .44$. There was, however, a significant difference between groups for neutral items at baseline $t(22) = -.2.51$, $p = .02$. Examination of the group means reveals that the BN group without comorbid disorders attributed greater probability to the initial conclusion than did the BN group with comorbid disorders.

Self-report inferential confusion

Using an independent samples t-test, it was determined that the BN group ($M = 93.92$; $SD = 37.93$) reported significantly more inferential confusion on the ICQ-EV than did the HC group ($M = 43.13$; $SD = 16.56$) $t(33.12) = 6.12$, $p < .001$.

There was no significant difference between the BN with comorbid disorders and BN without comorbid disorders groups on the ICQ-EV $t(22) = 1.42$, $p = .17$.

Discussion

The current study aimed to investigate the role of inferential confusion in inductive reasoning in BN. As has also been found in OCD samples (ex. Aardema et al., 2010; Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005), participants with BN reported significantly higher levels of inferential confusion on a self-report measure as

compared to the HC group. This finding suggests a tendency for individuals with BN to invest in possibility-based information at the expense of reality-based information. This finding is particularly of note as the items of this questionnaire (ICQ-EV) do not have ED-specific content.

The RIAT was employed in the present study as it has been successfully piloted and validated in an OCD sample demonstrating its ability to measure inductive reasoning and the over-investment in possibility-based information (Pélissier et al., 2009). On the RIAT, the BN group reported significantly less confidence in the initial conclusion following the presentation of alternatives on neutral items. There was no significant change in confidence in the HC group. This suggests that the BN group was more influenced by alternatives (i.e., possibility-based information) than the HC group, leading them to doubt the initial conclusion on neutral items. The finding that the BN group without comorbid disorders attributed greater probability to the initial conclusion than did the BN group with comorbid disorders indicates that the decrease in confidence in the initial conclusion observed for neutral items is primarily accounted for by the BN group without comorbid disorders. This suggests that the observed effect is not better accounted for by comorbidity, but rather, is attributable to BN. Contrary to expectations, there was no statistically significant change in confidence on BN-relevant RIAT items (though examination of the means suggests a trend toward increased confidence following the presentation of alternatives). Increasing confidence on BN-relevant items in the BN group may be related to the finding that the BN group had significantly lower baseline confidence in the initial conclusions. It is possible that the positive content of the initial conclusions presented in the BN-relevant items led participants in the BN group to have less confidence in these initial conclusions and invest in alternatives that more likely resemble

their reality. The significant decrease in confidence on neutral items observed in the BN group (but not in the HC group) supports the hypothesis that individuals with BN invest in possibility-based information leading to doubt, though this effect was not found for BN-relevant items.

Research of this kind addresses the need for research into reasoning processes in the area of EDs. The results of the present study suggesting differences in inductive reasoning are consistent with past research finding that individuals with BN adopted an excessive evidence gathering style on a probabilistic reasoning task (Sternheim et al., 2011). Taken together, these results highlight that BN may be associated with abnormal reasoning processes that are not yet well understood. The construct of inferential confusion may help us to better understand reasoning in BN. Inferential confusion may also represent a transdiagnostic cognitive process that may help to explain the relationship between OCD and BN. Clinically speaking, inductive reasoning characterized by inferential confusion and the resultant doubt may help to explain why someone with BN may be particularly invested in the belief that they may be overweight or at great risk of becoming so (i.e., possibility-based information), despite what they can see in the mirror or feel in their clothes (i.e., reality-based information). This suggests that interventions targeting inferential confusion (ex: psychoeducation pertaining to reasoning processes and errors, reality sensing, etc.) may be efficacious in the treatment of BN.

The interpretation of the results is limited by the small sample size. Though exclusion of male participants limits the generalizability of the results, it was not considered feasible to recruit a sufficient sample of men in order to conduct gender-based analyses. Lack of previous validation of the RIAT in ED samples represents another limitation, though the RIAT has been validated as a measure of doubt in OCD samples. Strengths of the study include the use of

both a self-report and an experimental measure of inductive reasoning characterized by doubt, demonstrating convergent validity.

Overall, the current study provides partial support for inductive reasoning characterized by doubt in BN, especially with regard to neutral stimuli. Future studies using the RIAT should investigate the impact of possibility-based information in BN-relevant situations employing items that allow for the examination of the effect of items that support and contradict the realities of BN symptomatology. Future research should also aim to investigate inferential confusion and its impact on reasoning and ED symptomatology in larger transdiagnostic ED samples. Studies allowing for comparisons with an OCD group would also inform our understanding of inferential confusion and highlight any differences or similarities in the manifestation of this process in EDs.

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Table 1

Example of a BN-relevant item on the Reasoning with Inductive Arguments Task

Premises	A friend tells you that you look slim today. You wonder what she meant.
Initial conclusion	You conclude the comment was a compliment. *
Alternative conclusions	Maybe you will conclude the comment was a way to tell you that you looked fat yesterday. Maybe you will think your friend was warning you to be careful with what you eat. Perhaps you will work harder to maintain your current diet, as it seems to be working. *

Note. * Denotes when participants are asked to rate their level of confidence in the initial conclusion.

Table 2

Example of a neutral item on the Reasoning with Inductive Arguments Task

Premises	It has been raining a lot since the beginning of the day. You planned to go to a backyard party in the afternoon.
Initial conclusion	You decide not to go because the party is likely to be cancelled. *
Alternative conclusions	Maybe you will go to the party anyway, in spite of the rain. Perhaps the party may take place under tents. Maybe you will decide to have people over at your house instead. *

Note. * Denotes when participants are asked to rate their level of confidence in the initial conclusion.

Table 3

Confidence in a conclusion pre- and post- the presentation of alternatives on the Reasoning with Inductive Arguments Task

Group	Item type	Initial	Post-alternatives
		M(SD)	*M(SD)*
BN	BN-relevant	36.68(20.01)	43.56(21.39)
	Neutral	54.7(14.25)	45.5(14.2)
HC	BN-relevant	75.71(11.58)	71.89(16.14)
	Neutral	56.88(15.43)	55.73(16.17)

Note. Higher scores indicate greater confidence in the given conclusion. BN = bulimia nervosa; HC = healthy control.

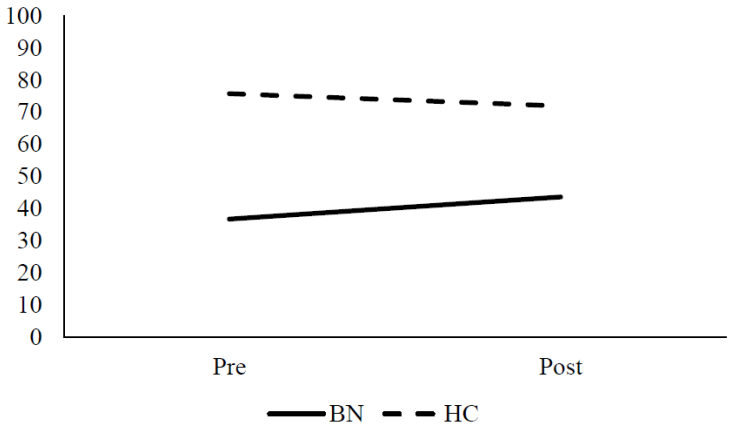

Figure 1. Changes in confidence from pre- to post the presentation of alternative conclusions for items with BN-relevant content.

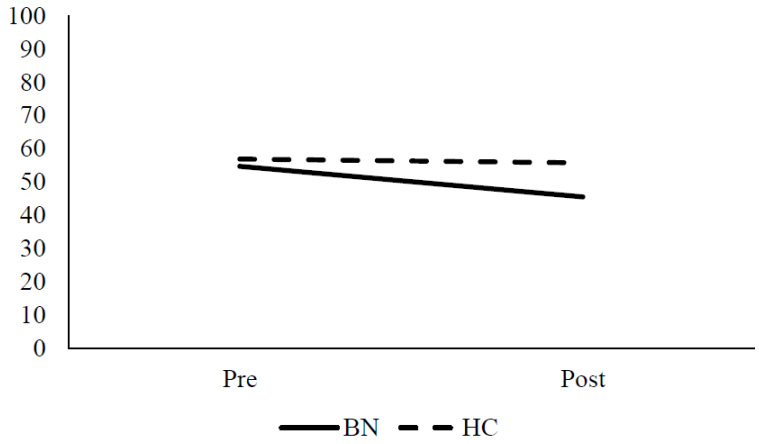

Figure 2. Changes in confidence from pre- to post the presentation of alternative conclusions for items with neutral content.

Article 2: Doubt and fear of self in bulimia nervosa[2]

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This work was supported by the Fonds de Recherche du Québec – Santé [#33663] and by the Canadian Institutes of Health Research [#114905]. The authors would also like to acknowledge the statistical support provided by Charles-Édouard Giguère, MSc.

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[2] This is the accepted version of the following article: Wilson, S., Aardema, F., & O'Connor, K. (2017). Doubt and fear of self in bulimia nervosa. *International Journal of Eating Disorders, 50*, 1437-1441, which has been published in final form at https://onlinelibrary.wiley.com/doi/abs/10.1002/eat.22789. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions.

Abstract

Objective: Several overlapping cognitive processes have been identified in eating disorders (EDs) and obsessive compulsive disorder (OCD). Drawing from the OCD literature, the present study examined whether bulimia nervosa (BN) is associated with a maladaptive inductive reasoning style characterized by the over-investment in possibility-based (as opposed to reality-based) information. **Method:** Women with BN (n = 25) and healthy controls (HC; n = 24) completed the Inference Processes Task (IPT), an ecological inductive reasoning task previously validated in OCD samples. Participants also completed the Fear of Self Questionnaire (FSQ) that evaluates investment in a feared possible identity. **Results:** Significant differences on the IPT indicate that the BN group was more influenced by possibility-based information throughout the task than the HC group $F(5.44, 255.78) = 6.94$, $p > .001$. It was also found that the BN group scored significantly higher on the FSQ than the HC group $t(29.98) = 8.4$, $p > .001$, replicating previous findings. Finally, scores on the IPT were significantly correlated with measures of symptom severity. **Discussion:** These findings suggest that BN may be associated with maladaptive inductive reasoning processes characterized by over-investment in possibility-based feared outcomes and identities.

Keywords: bulimia nervosa; inductive reasoning; fear of self

Doubt and fear of self in bulimia nervosa

The factors underlying body image disturbance and unhealthy weight loss behaviours in eating disorders (EDs) are not yet fully understood, though there has been a recent call for the investigation of relevant cognitive factors (Frank & Treasure, 2016). It is puzzling how someone at a low or healthy weight can believe they are overweight, or at great risk for becoming so. Several cognitive processes have been identified, some of which are common to both bulimia nervosa (BN) and obsessive compulsive disorder (OCD), such as perfectionism and thought-fusion, highlighting similarities between both disorders (Shafran, 2002). However, other cognitive processes such as reasoning, which have been identified and studied in OCD (ex: Pélissier & O'Connor, 2002), have not yet been investigated in BN or other EDs. The identification of transdiagnostic reasoning processes may lead to a better understanding of BN and OCD.

To our knowledge, only a single study has explicitly evaluated reasoning in EDs, and found that BN was associated with an excessive evidence gathering style on a probabilistic reasoning task (Sternheim, Startup, & Schmidt, 2011). The authors also noted that this reasoning style was influenced by uncertainty. Similar to EDs, OCD has also been associated with impaired performance on probabilistic reasoning tasks (Fear & Healy, 1997) and relatedly, with impaired inductive reasoning (Pélissier & O'Connor, 2002; Simpson, Cove, Fineberg, Msetfi, & Ball, 2007). Additionally, abnormalities in inductive reasoning have been linked to uncertainty and doubt in OCD (Pélissier, O'Connor, & Dupuis, 2009; Simpson et al., 2007).

The relationship between doubt and inductive reasoning, that is, reasoning incorporating information from one's imagination or past experiences with information

coming from the environment or given premises, has been explored in several studies in OCD. It was found that individuals with OCD accord undue importance to possibility-based information (OCD-relevant example: Maybe my hands are dirty; ED-relevant example: Maybe I have gained weight) at the expense of reality-based (or sensory) information (OCD-relevant example: I do not see any dirt on my hands; ED-relevant example: My clothes still fit the same), thereby eliciting doubt and contributing to ineffective inductive reasoning. Evidence for the over-investment in possibility-based information in OCD has been found on formal inductive reasoning tasks (Pélissier et al., 2009) as well as ecologically-valid measures of inductive reasoning (Aardema, O'Connor, Pélissier, & Lavoie, 2009; Nikodijevic, Moulding, Anglim, Aardema, & Nedeljkovic, 2015). Furthermore, an over-investment in possibility-based information through a disproportionate investment in a feared possible self has been associated with OCD (ex: Aardema et al., 2013), and most recently EDs as well (Purcell Lalonde, O'Connor, Aardema, & Coelho, 2015). Fear of self refers to qualities or characteristics a person fears they may possess (Markus & Nurius, 1986), which in the context of EDs may relate to the possibility of becoming overweight and rejected by others.

The present study aimed to investigate reasoning processes in EDs, an understudied area despite the recognized importance of cognitive processes in this population. For the purposes of this initial investigation, inductive reasoning in ED-relevant contexts was explored. It was hypothesized that the BN group would evince greater levels of doubt on an inductive reasoning task and greater fear of the possible self as compared to the healthy control (HC) group. It was also hypothesized that severity of ED symptoms would be associated with higher levels of over-investment in possibility. Individuals with BN rather than anorexia nervosa were recruited given the potential effect of low weight on cognitive

performance. Moreover, in line with the transdiagnostic model of EDs differences in cognitive processes would not be expected between ED subtypes.

Method

Participants

Twenty-five women with BN and 25 HC women were recruited for the present study. Presence of traumatic brain injury, evidence of current or past schizophrenia, bipolar or organic mental disorder, and the inability to read and/or understand either English or French were exclusionary criteria for the present study. Severe psychopathology and history of eating pathology were also exclusion criteria for the HC group. All participants in the BN group met the criteria outlined in the fifth edition of the Diagnostic and Statistical Manual (DSM 5; American Psychiatric Association, 2013) for BN except for three individuals who reported primarily subjective binge episodes, but who otherwise demonstrated severe eating pathology consistent with BN. Of the BN group, 40% were undergoing treatment at the time of testing. There was no significant difference between groups for education level χ^2 (5, N = 49) = 1.15, p = .95. See Table 1 for means and standard deviations for questionnaires and other demographic variables.

Procedure

The present study was approved by the Research Ethics Board at the Montréal Mental Health University Institute and conforms to the Declaration of Helsinki ethical standards. Participants were recruited from the community using advertisements. To ensure eligibility, participants were screened using standard diagnostic questions pertaining to their eating habits, mood, anxiety, psychosis, and substance use over the telephone. Participants completed the questionnaires and reasoning tasks online using survey software and were subsequently

invited into the laboratory for the administration of diagnostic interviews (see Measures section).

Measures

The Eating Disorders Examination (EDE; Fairburn & Cooper, 1993) is a semi-structured interview used to evaluate eating pathology.

The Eating Attitudes Test (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982) is a 26-item questionnaire measuring the nature and severity of eating pathology. The internal consistency in the present sample was excellent (α = .96).

The short-form of the Body Shape Questionnaire (BSQ-8C; Evans & Dolan, 1993) is an 8-item self-report measure that was used to assess body dissatisfaction. This measure had excellent internal consistency in the current sample (α = .97).

The Fear of Self Questionnaire (FSQ; Aardema et al., 2013) is a 20-item self-report questionnaire measuring a person's fear of who they might be or who they might become (example item: I'm afraid of the kind of person I might become if I'm not very careful). This questionnaire demonstrated excellent internal consistency in the current sample (α = .985).

The Inference Processes Task (IPT; Aardema et al., 2009) is an experimental task measuring doubt as a dynamic and fluctuating process, highlighting the difference in influence of possibility-based and reality-based information. The IPT measures the extent to which an individual accords importance to possibility-based information even in the presence of reality-based information. It was modified from the original to include BN-relevant information. Two separate BN-relevant scenarios were presented.

Following the presentation of a scenario, participants were asked to estimate the probability of a feared outcome (ex: gaining weight after eating fast food) on a scale from 0-

100. These initial scores acted as a baseline measure of the participants' level of doubt with higher estimates of probability indicating higher levels of doubt. Participants were then presented with a piece of reality-based information suggesting that the feared outcome did not occur, followed by a piece of possibility-based information that could potentially negate the previous piece of reality-based information. Six pairs of reality and possibility-based information were presented in total. Between the presentation of each piece of information, the participant was asked to estimate the probability of the feared outcome.

Two separate BN-relevant scenarios were presented. Scenario 1 described getting fast food and the feared possible outcome was gaining weight. Scenario 2 described meeting new people and the feared possible outcome was the negative evaluation of one's appearance by others.

Results

One of the HC participants was found to be a significant outlier on most questionnaires and was excluded from the present analyses.

Repeated measures ANOVA was conducted to determine the role of possibility as compared to reality-based information on the perceived probability of a feared outcome following the presentation of a scenario. As Mauchly's test of sphericity was significant, the Greenhouse-Geisser corrected values are reported. Furthermore, Levene's test of homogeneity of variance was also significant. The data were transformed, correcting this violation, but the results remained the same. As such, the untransformed results are reported.

Scenario 1 (Sc1) and Scenario 2 (Sc2). An initial repeated measures ANOVA was conducted which included only the baseline (immediately following the scenario) and the final probability estimate to examine the outcome of reasoning. The between subjects effect was

significant. Post hoc analyses indicated that there was a significant difference between groups at baseline and for the final estimate, with the BN group reporting greater probability estimates at both time points. The effect sizes obtained were large. See Table 1.

Repeated measures ANOVA including all time points was conducted. Within subjects analyses revealed a significant main effect of time (Sc1: $F(6.09, 286.36) = 3.79$, $p = .001$, $d = .57$; Sc2: $F(5.44, 255.78) = 17.81$, $p < .001$, $d = 1.23$) and a significant time by group interaction (Sc1: $F(6.09, 286.36) = 2.61$, $p = .02$, $d = .47$; Sc2: $F(5.44, 255.78) = 6.94$, $p < .001$, $d = .77$) with effect sizes ranging from medium to large. These results suggest that probability estimates change over time (i.e., depending on the type of information presented) and that the pattern of fluctuation differed between groups. Post hoc analyses suggest that the BN group demonstrated greater fluctuation in probability than the HC group as shown in Figure 1. The Sidak correction was used to account for multiple contrasts.

Correlations. Significant correlations were observed between each time point of the IPT and the total scores of several clinical measures. For Sc1, correlations with the EAT-26 ranged from .62 to .79, with the BSQ-8C from .58 to .76, and with the FSQ from .38 to .55. For Sc2, correlations with the EAT-26 ranged from .53 to .74, with the BSQ-8C from .51 to .78, and with the FSQ from .35 to .59. The FSQ was also significantly correlated with the EAT-26 ($r = .66$, $p > .001$) and BSQ-8C ($r = .78$, $p > .001$).

Discussion

The aim of the present study was to investigate maladaptive inductive reasoning processes characterized by an over-investment in possibility-based information in BN-relevant contexts. The first hypothesis was supported. There were large baseline differences between groups on both scenarios, suggesting a tendency to become easily immersed in a narrative for

those with BN, while subsequent greater fluctuation in the BN group showed that doubt was maintained due to a higher impact of possibility-based information negating reality-based information. These findings are consistent with results found in previous research with OCD samples (Aardema et al., 2009; Nikodijevic et al., 2015). Furthermore, in a recent meta-analysis on the topic of intolerance of uncertainty, a construct that is related to doubt but is conceptually different, Brown and colleagues (2017) reviewed several articles pointing to differences in decision-making under conditions of uncertainty. These findings are in line with those of the present study. The authors also call for a novel measure of uncertainty that includes ED-relevant threat cues (Brown, et al., 2017). The IPT responds to the need for novel behavioural measures of uncertainty/doubt in EDs.

With regards to the second hypothesis, it was found that the BN group experienced greater levels of fear of self than the HC group replicating previous findings in OCD (Aardema et al., 2013; Nikodijevic et al., 2015) and EDs (Purcell Lalonde et al., 2015). It is also of note that fear of self and estimates of probability on the IPT are positively correlated with ED symptoms, indicating that these processes potentially influence symptomatology or vice versa.

The relatively small sample size limits the interpretation of the results. The lack of a neutral scenario is a limitation to evaluating reasoning in non-disorder-specific situations. These results are preliminary, but promising. Future research into inductive reasoning processes across different contexts is warranted. The present study was strengthened by the replication of the results using two separate scenarios.

Overall, the present study found support for the link between BN and maladaptive inductive reasoning operationalized as the over-investment in BN-relevant possibility-based

information as it applies to feared outcomes and feared identities. The importance of transdiagnostic research is highlighted through the identification of an overlapping cognitive factor, which allows us to go beyond content and into process.

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Table 1

Demographic characteristics, questionnaire, and Inference Processes Task results

	BN (*n* = 25)	HC (*n* = 24)	*t*	*df*	*p*	*d*
	M(SD)	*M(SD)*				
Age*	26.92(8.98)	26.13(4.78)	.39	36.89	.70	.11
BMI	23.65(3.70)	22.86(3.02)	.82	46	.42	.23
EAT-26*	37.24(13.86)	6.46(4.12)	10.63	28.34	< .001	2.98
BSQ-8C	39.12(6.24)	13.88(5.15)	15.41	47	< .001	4.40
FSQ*	74.24(25.69)	28.42(8.97)	8.4	29.98	< .001	2.36
	M(SD)	*M(SD)*	*f*	*df*	*p*	*d*
IPT Scenario 1						
Between subjects effect			49.05	1, 47	< .001	2.04
Baseline	47.20(24.07)	12.08(12.85)	40.10	1, 47	< .001	1.82
Final Estimate	44.80(25.02)	5.83(10.18)	50.20	1, 47	< .001	2.04
IPT Scenario 2						
Between subjects effect			51.45	1, 47	< .001	2.09
Baseline	47.20(24.41)	10.42(12.33)	43.75	1, 47	< .001	1.90
Final estimate	34.00(22.91)	2.50(5.32)	43.10	1, 47	< .001	1.89

Note. BMI missing for one participant in the BN group. BN = bulimia nervosa; HC = healthy controls; BMI = body mass index; EAT-26 = Eating Attitudes Test; BSQ-8C = Body Shape Questionnaire, version 8C; FSQ = Fear of Self Questionnaire; IPT = Inference Processes Task.

*Equal variances not assumed.

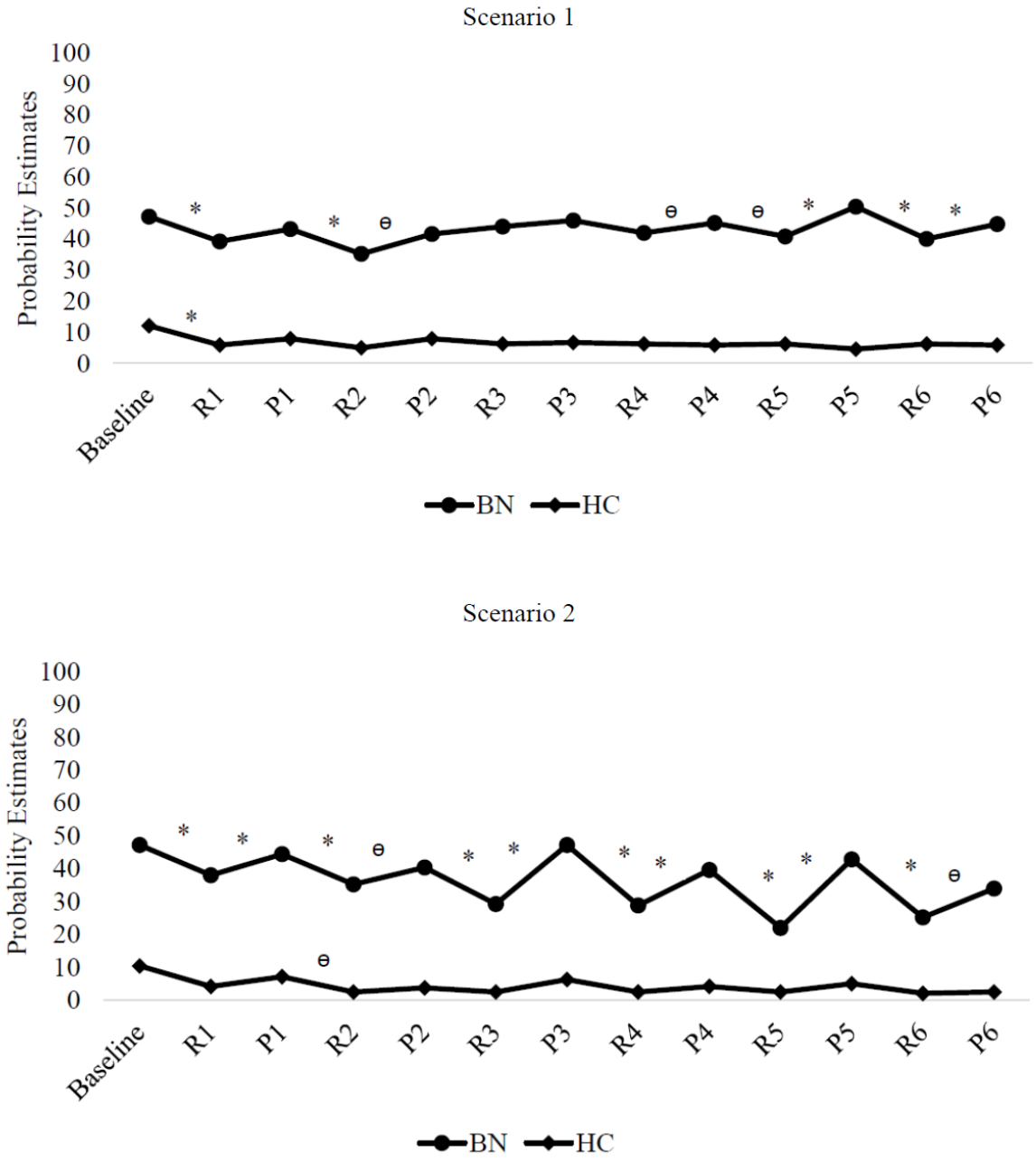

Figure 1. Fluctuations in estimated probability of the feared outcome for Scenario 1 and Scenario 2. R = reality-based information; P = possibility-based information.

* p > .001

ɵ p > .05

Article 3: What do I look like? Perceptual confidence in bulimia nervosa[3]

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This work was supported by the Fonds de Recherche du Québec – Santé [#33663] and by the Canadian Institutes of Health Research [#114905]. The authors would also like to acknowledge the statistical support provided by Charles-Édouard Giguère, MSc.

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[3] This is a post-peer-review, pre-copyedit version of an article published in Eating and Weight Disorders – Studies on Anorexia, Bulimia, and Obesity: Wilson, S., Aardema, F., & O'Connor, K. (2018). What do I look like? Perceptual confidence in bulimia nervosa. *Eating and Weight Disorders*, doi: 10.1007/s40519-018-0542-x. The final authenticated version is available online at: https://doi.org/10.1007/s40519-018-0542-x.

Abstract

Cognitive confidence, a type of metacognition referring to confidence in one's cognitive abilities (ex: memory, perception, etc.), has been identified as relevant to eating disorders (EDs) using self-report measures. Repeated checking has been found to elicit decreases in perceptual confidence in obsessive compulsive disorder (OCD). The purpose of the present study was to experimentally investigate perceptual confidence, a type of cognitive confidence, in EDs. Specifically, this construct was investigated in the context of body checking, a behaviour with similarities to compulsive checking as observed in OCD. Women with bulimia nervosa (BN; $n = 21$) and healthy controls (HC; $n = 24$) participated in the study. There were no group differences with regards to perceptual confidence at baseline $F(1, 43) = .5$, $p = .48$, $\eta_p^2 = .01$, but a significant difference was observed post-checking $F(1, 43) = 7.79$, $p = .008$, $\eta_p^2 = .15$, which was accounted for by significant decreases in perceptual confidence in the BN group $F(1, 43) = 13.31$, $p < .001$, $\eta_p^2 = .24$. Similar to compulsive checking in OCD, body checking may paradoxically decrease confidence regarding one's appearance.

Keywords: bulimia nervosa; body checking; metacognition; perceptual confidence

Level of evidence: No level of evidence for experimental study article

What do I look like? Perceptual confidence in bulimia nervosa

Metacognition, referring to the beliefs held about one's thoughts and cognitive processes, has emerged as a relevant construct in several psychiatric disorders [1]. Cognitive confidence is a form of metacognition pertaining to the degree of confidence one has regarding one's cognitive abilities, including memory, reality monitoring, attention, and perception. Using self-report and experimental methods, considerable support has been found for the role of low cognitive confidence in obsessive compulsive disorder (OCD), particularly with regards to compulsive checking. This line of research highlights a paradoxical relationship between compulsive checking and cognitive confidence, in that checking is performed to increase certainty, but actually seems to erode it [see 2 for a discussion]. Given its important role in compulsive checking in OCD, cognitive confidence warrants examination in other psychiatric disorders exhibiting similar behaviours.

In particular, compulsive checking in OCD is conceptually similar to body checking in eating disorders (EDs). Looking in the mirror repeatedly or for long periods of time, checking for 'tightness' in specific pieces of clothing, frequent weighing, and reassurance seeking are examples of body checking behaviours [3]. Body checking is a common clinical behaviour across EDs, with some research suggesting that it may be particularly prevalent in bulimia nervosa (BN) [4]. Of interest to the study of body checking is research demonstrating that perseverative attending (i.e., staring), as occurs in body checking, has also been found to elicit low perceptual confidence in non-clinical samples using OCD-relevant tasks [5, 6]. Perceptual confidence is a subtype of cognitive confidence referring to confidence in one's perceptual abilities (usually visual).

As in OCD, body checking in EDs is often performed to increase certainty, but often paradoxically elicits adverse effects. In a study investigating attitudes towards body checking, it was found that this behaviour often provides short-term reassurance regarding weight, but generates distress in the long term [7]. Indeed, body checking has been found to increase the fear of fatness, body dissatisfaction, self-critical thoughts, and weight and shape concerns [8, 9]. Moreover, body checking has been identified as a maintenance factor for body image disturbance [10]. It may be that body checking elicits body dissatisfaction and low perceptual confidence, which may in turn promote more body checking, among other pathological behaviours and attitudes.

Several studies have found an association between low cognitive confidence and EDs [11-15]. These studies utilised the short form of the Metacognitions Questionnaire (MCQ-30) [16], a general measure of metacognition with a cognitive confidence subscale. To our knowledge, however, no study has evaluated cognitive confidence or any of its subtypes in EDs either through the use of a disorder-specific questionnaire or any experimental paradigm.

The present study aims to experimentally evaluate the role of perseverative attending to the body in the form of body checking and its impact on perceptual confidence. It is hypothesized that BN will be associated with decreased confidence in estimates of body size (i.e., decreased perceptual confidence) following a body checking task. It is also hypothesized that body checking will elicit increased body dissatisfaction in the BN group. Finally, the present study sought to evaluate perceptual confidence in EDs using a self-report questionnaire. It is hypothesized that individuals who engage in more body checking will also report lower perceptual confidence.

Method

Participants

Fifty participants (25 BN and 25 healthy control [HC] participants) were recruited from the community. Potential participants responded to advertisements on websites (ex: Kijiji®), social media (ex: Facebook®), a newspaper, and in universities. Inclusion criteria: 1) aged 18-45; and 2) primary diagnosis of BN (for BN group only). Exclusion criteria: 1) traumatic brain injury; 2) evidence of current or past schizophrenia, bipolar disorder, or organic mental disorder; and 3) inability to read and/or understand either English or French. Exclusion criteria specific to the HC group were the presence of severe psychopathology, current ED, or history of an ED. To avoid creating an artificial HC group, however, several HC participants were admitted into the study despite reporting mild symptoms congruent with specific phobia (n = 2), panic attacks (n = 2), and generalized anxiety disorder (n = 1) during the phone evaluation. All participants in the BN group met full DSM 5 criteria for BN except for three participants, who instead met criteria for an ED not otherwise specified (EDNOS) as they demonstrated primarily subjective binge episodes. The following comorbid disorders were observed in the BN group: depression (n = 2), substance use disorder (n = 5), panic disorder (n = 1), specific phobia (n = 6), and generalized anxiety disorder (n = 3). Finally, 28% of participants in the BN group reported the use of psychoactive medications, 32% were receiving psychological treatment for an ED at the time of study participation, and another 52% reported past psychological treatment (20% for an ED and 32% for another reason). Participants were compensated financially for their time.

Four participants in the BN group did not complete the study for ethical reasons (participant unwillingness or distress). Furthermore, one of the HC participants was identified as an outlier; it was evident that this participant had systematically answered the lowest

possible value on all measures of confidence pre- and post- body checking. Exclusion of this participant resulted in better model fit, but did not significantly alter main and interaction effects. The final sample consisted of 21 women with BN and 24 women in the HC group.

Measures

A pre-screening questionnaire [17] was used to evaluate the inclusion/exclusion criteria over the phone prior to entry into the study.

The *Structured Clinical Interview for DSM-IV Axis I disorders* (SCID-I) [18] is a semi-structured interview used to diagnose Axis I disorders. When compared to other clinical interviews, the SCID-I has been found to have superior validity [19]. This interview was used to evaluate comorbid disorders in the BN group.

The *Eating Disorders Examination* (EDE) [20] is a clinician-administered semi-structured interview. This interview establishes the diagnosis of EDs by evaluating the presence or absence of relevant behavioural and cognitive symptoms for the preceding 3-month period. The reliability, discriminant validity, and internal consistency of the EDE are all excellent [20, 21]. Diagnostically relevant questions were assessed over the lifetime to confirm that the HC group did not have a history of an ED.

A *Body Checking Task* (BCT) was created for the purposes of the present study to evaluate whether perseverative attending, as is characteristic of body checking, results in decreased perceptual confidence regarding the size of the body. The BCT was comprised of two parts. Part 1: Participants were instructed to look into a mirror at specified body parts - arms, stomach, hips, and thighs – each for 15 seconds (to prevent them from spontaneously engaging in body checking behaviours). After the examination of a body part, participants were asked to estimate its circumference. Once all body parts were examined and estimates

given, participants were asked to assess their confidence in the accuracy of their estimates (i.e., perceptual confidence) as well as their degree of body dissatisfaction regarding each of these body parts on visual analogue scales (VAS). Part 2: The body part rated as the least satisfactory during the first part of the task was selected for examination in the second part. Participants were instructed to examine the selected body part for a period of 10 minutes and were told that this was to gain more information about the nature of it. Participants were told they could examine the body part from different angles, touch it, and/or sit in a chair to see how it looked when sitting. Following this, participants were asked to re-assess their confidence in the accuracy of their initial estimates as well as their degree of dissatisfaction towards each body part. Decreases in confidence in the accuracy of the initial estimates suggests lower perceptual confidence following body checking.

The BCT is based on the low and high body checking conditions of the task used by Shafran and colleagues [9], which was validated as a manipulation of body dissatisfaction. The BCT differs in that participants were not asked to describe their bodies in a neutral manner in Part 1 (low checking condition) and the instructions to engage in body checking behaviours were presented as suggestions in Part 2 (high checking condition). These differences reflect that the purpose of the present study was to compare 'normal' versus perseverative body checking behaviours to evaluate the effects on perceptual confidence. The procedure for body size estimation was based on that used by Smeets and colleagues [22], designed with the aim of eliciting focus on a particular aspect of body checking, that is, the size of different body parts. The BCT builds on manipulation procedures utilised in these other tasks to test the hypothesis that increased focus on specific body parts, as is characteristic of prolonged checking, not only elicits body dissatisfaction, but also elicits decreased perceptual

confidence as has been found in the OCD literature [5, 6]. For this reason, the overall structure of the BCT is based on the methodology of a study measuring the effects of perseverative checking in OCD [5]. As in the present study, van den Hout and colleagues asked participants to look at the stimulus for a few seconds, complete a measure of perceptual confidence, check the stimulus for 10 minutes, and complete a measure of perceptual confidence a second time [5].

Perceptual confidence (confidence in the accuracy of estimates of body part size during the BCT) was measured using a VAS (VAS-P) ranging from ‘not at all confident’ to ‘extremely confident’. Participants were asked to indicate their response by placing an "X" on a line measuring 10 centimetres. Body satisfaction was measured using a VAS (VAS-S) ranging from ‘not at all satisfied’ to ‘extremely satisfied’.

The *Eating Attitudes Test* (EAT-26) [23] is a 26-item measure of the nature and severity of eating pathology on a 6-point Likert scale ranging from 'always' to 'never'. The total score and each of the three subscales have demonstrated acceptable internal consistency in a bilingual sample with BN (α = .72 - .89) [24].

The *Body Checking Questionnaire* (BCQ) [10] is a 23-item self-report questionnaire that assesses a variety of body checking behaviours along a scale from 1 ('never') to 5 ('very often'). The BCQ has also demonstrated excellent test-retest reliability (r = .94) and convergent validity when compared with other measures of negative body image and EDs [10]. The BCQ was administered to determine the degree of body checking outside of the laboratory-based BCT.

The *Distrust of the Senses in Eating Disorders* scale (DSED) is a 10-item self-report questionnaire developed using expert consensus for the purposes of the present study. The

DSED assesses an individual's confidence in their senses (visual and tactile senses as well as bodily signals). Items include ‘The way I perceive my body when I look in the mirror is accurate’ and ‘I trust that I am able to see what I look like in reality’. These items are rated on a 5-point Likert scale ranging from 'I do not doubt this at all' to 'I doubt this very strongly' (with higher scores indicating more distrust, or put another way, less confidence). The DSED was administered to measure trait levels of perceptual confidence (i.e., doubt in perception abilities) and to complement the state levels measured by the laboratory-based BCT. The questions and Likert scale were influenced by the Brief Cognitive Confidence Questionnaire [2]. The DSED demonstrated excellent internal consistency in the current sample (α = .93).

Materials

Online survey software, SurveyMonkey®, was used to administer self-report questionnaires. Participants received a link to access these questionnaires via email.

Height was calculated in inches using a soft tape measure affixed to the wall. Weight was measured by a calibrated scale.

Procedure

Participants were screened over the telephone to ensure eligibility. Eligible participants were emailed a link to the consent form and completed the questionnaires online. Once the questionnaires were completed, participants were scheduled for an appointment in the laboratory. The EDE (both groups) and SCID-I (BN group only) interviews were administered by the experimenter (SW). Participants' height and weight were also measured by the experimenter to determine body mass index (BMI). Following this, participants completed the BCT. Participants were then debriefed as to the purposes of the study. Throughout each step of the study, participants were monitored for signs of distress and deterioration. Participants were

given contact information for the experimenter and other resources in the event that they experienced negative effects following the BCT.

Statistics

Upon inspection of the variable residuals, it was determined that the post-checking data were skewed. A natural logarithmic transformation was applied to all data.

Repeated measures analysis of variance (ANOVA) was used to assess the effect of body checking on two dependent variables that were each assessed both pre- and post- body checking: perceptual confidence (VAS-P) and body satisfaction (VAS-S). Group (BN vs. HC) was the independent variable.

Pearson bivariate correlations were conducted in order to examine the relation between perceptual confidence as measured by the VAS-P, general confidence in the senses as measured by the DSED, and checking behaviour as measured by the BCQ. A change score was calculated for perceptual confidence from pre- to post- checking.

Results

See Table 1 for means and standard deviations for demographic variables and questionnaires.

Perceptual Confidence

The omnibus test was significant and revealed a main effect of time $F(1, 43) = 9.47$, $p = .004$, $\eta_p^2 = .18$ as well as a time by group interaction effect $F(1, 43) = 5.07$, $p = .03$, $\eta_p^2 = .11$. Post hoc analyses indicated that there was no significant difference between groups with regards to perceptual confidence at baseline $F(1, 43) = .5$, $p = .48$, $\eta_p^2 = .01$, but that there was a statistically significant difference between groups post-checking $F(1, 43) = 7.79$, $p = .008$, $\eta_p^2 = .15$. Post hoc analyses also revealed that perceptual confidence in the BN group

significantly decreased from pre- to post- checking $F(1, 43) = 13.31$, $p < .001$, $\eta_p^2 = .24$, while no change was observed in the HC group $F(1, 43) = .37$, $p = .55$, $\eta_p^2 = .008$. See Figure 1.

An additional analysis was conducted to examine the potential role of comorbidity in the BN group on the results. There was no significant difference with regards to change in perceptual confidence from pre- to post- checking between BN participants with ($n = 11$) and BN participants without ($n = 10$) comorbid disorders $t(19) = 1.11$, $p = .28$.

Satisfaction

An independent samples t-test revealed there was a significant difference between groups on degree of satisfaction pre- $t(43) = -6.26$, $p < .001$, $d = 1.89$ and post-checking $t(43) = -5.38$, $p < .001$, d = 1.64, with the BN group evincing significantly less body satisfaction. Repeated measures ANOVA was also used to assess the effect of body checking on degree of satisfaction. The omnibus test was non-significant indicating there was neither a main effect of time $F(1, 43) = .06$, $p = .81$, $\eta_p^2 = .001$, nor was there a time by group interaction $F(1, 43) = .23$, $p = .63$, $\eta_p^2 = .005$. See Figure 2.

Correlations

The perceptual confidence change score was significantly correlated with the DSED ($r = -.35$, $p = .019$) and the BCQ ($r = -.43$, $p = .003$). Furthermore, the DSED and the BCQ were found to be significantly correlated with one another ($r = .87$, $p < .001$).

A statistically significant correlation was also observed between the severity of eating pathology, as measured by the EAT-26, and the change in perceptual confidence from pre- to post checking ($r = .49$, $p = .001$).

Discussion

The present study aimed to investigate body checking as a behaviour that may decrease perceptual confidence and ultimately increase body dissatisfaction. Results support the hypothesis that perseverative attending to the body during body checking elicits low perceptual confidence in individuals suffering from BN, but has no effect on participants without eating pathology. This finding is consistent with previous research that has found an association between perseverative attending and reduced perceptual confidence using OCD-relevant stimuli [5, 6] and points to the relevance of this association in body checking as well. Unlike previous studies [8, 9], however, body checking had no effect on body dissatisfaction either in the BN or HC groups. It is possible that this is due to a floor effect as satisfaction toward the body was already very low at baseline in the BN group. This finding also suggests that perceptual confidence and body dissatisfaction are distinct. Change in perceptual confidence was also significantly correlated with severity of eating pathology, validating the main findings of the study. Finally, there was no difference between participants in the BN group with and without comorbid disorders in terms of change in perceptual confidence, suggesting that the results are not better accounted for by comorbidity.

Regarding the novel self-report measure of perceptual confidence, correlational analyses suggest that larger decreases in confidence from pre- to post- checking are significantly correlated with higher scores on a measure of trait/habitual body checking and greater scores on a trait measure of perceptual confidence in ED-specific (body-related) situations. Furthermore, trait/habitual body checking and low perceptual confidence (as measured by the questionnaire) were significantly associated with one another. This result lends support to the experimental finding that increased body checking is related to decreased perceptual confidence. The lack of baseline differences in terms of confidence despite the

correlation between the trait/habitual measures of body checking and questionnaire measure of perceptual confidence regarding the body may also imply that even though low perceptual confidence can be triggered by body checking, it is a temporary and fluctuating state. This is in line with previous research that has found that body image disturbance fluctuates across time and across contexts [25-29]. It is possible that reduced perceptual confidence elicited by body checking contributes in part to fluctuations in body image disturbance. The present study also has other important clinical implications as the results suggest that body checking may also elicit decreased perceptual confidence and certainty, which may in turn encourage further checking resulting in a vicious cycle. Indeed, the paradoxical and self-maintaining cycle of checking and the role of low cognitive confidence is already well documented in OCD [ex: 2].

The role of cognitive confidence in eating pathology represents an understudied area, however, there are several studies that have suggested the relevance of this construct, though using different terminology. Lautenbacher and colleagues [30] conducted a study using a body size estimation task in a non-clinical sample. They found significant differences in estimation accuracy between restrained (i.e., adhering to a diet) and unrestrained (i.e., eating in response to physiological cues) eaters, but determined that this effect was mainly driven by the unrestrained group. The authors concluded that uncertainty with regards to body size may have played an important role in this study. It was suggested that uncertainty may represent a predisposition that interacts with other cognitive and affective factors to elicit body size overestimation in EDs [30]. The uncertainty observed in this study may have been related to decreases in perceptual confidence elicited by the body estimation task. Perceptual confidence may help to explain inconsistent findings across experimental studies of perception using body size estimation tasks [31]. That is, overestimation of body size may be triggered by the

experimental (body-focused) context and hence be accounted for by cognitive processes rather than actual perceptual deficits. Furthermore, Espeset and colleagues [32] found that body image disturbance is triggered by different contextual cues and that this susceptibility seems to be augmented by subjective uncertainty regarding the body's appearance (potentially a manifestation of low perceptual confidence).

Treatment for EDs may benefit from the addition of interventions addressing perceptual, and possibly other forms of cognitive confidence, especially with individuals who engage in body checking. One particular treatment, termed Inference Based Treatment (IBT), is designed to directly address doubt elicited in part by low confidence in sensory information in OCD [33]. Doubt and uncertainty are closely related, but distinct constructs. Doubt is uncertainty in the face of sensory information ('I am looking in the mirror, but I'm unsure what I look like') and so speaks directly to perceptual confidence, whereas uncertainty occurs in relation to circumstances about which one does not yet have information ('In the future, I might become fat'). It was found that IBT adapted for EDs was associated with clinically significant decreases in eating pathology [34]. Addressing perceptual confidence in standard cognitive behavioural treatment for BN might involve targeting beliefs about one's senses as well as body checking behaviours.

The present study has several limitations. Actual body size was not measured during the body checking task, which precluded the evaluation of body size estimation accuracy. This was done in an effort to obtain a pure measure of confidence in the perception of the body that would not be influenced by access to objective information (for example, learning the actual circumference of one's waist may have elicited body dissatisfaction beyond the effects of body checking). Additionally, the absence of objective measurement is more in line with most

body checking rituals (ex: staring in the mirror, reassurance seeking, etc.). Another potential limitation is the absence of a control condition. Future studies with larger samples should incorporate a control condition into the study design to rule out the possibility that confidence decreases naturally over time following brief exposure to one's body. Though a fairly small sample size was employed, the effect sizes obtained allow for confidence in the robustness of the effects observed. Another limitation was the presence of substantial comorbidity in the present sample, though the results indicate no difference in change in perceptual confidence between those with and without comorbidity. High rates of comorbidity also represent the clinical reality of EDs and their inclusion in the sample contributes toward the generalizability of the results obtained. Finally, though the questionnaire measuring perceptual confidence that was created for this study (DSED) demonstrated excellent internal consistency in this sample, it has not yet been validated. A targeted psychometric study using a larger sample size is required. The present study also had several strengths. Notably, the utilisation of self-report measures, semi-structured diagnostic interviews, and an experimental task allows for convergent validity and adds strength to the conclusions drawn from the results. Additionally, to our knowledge, this is the first study to evaluate any form of cognitive confidence in EDs using an experimental paradigm.

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Table 1

Demographic characteristics and eating disorder-related variables

	BN (n = 21)	HC (n = 24)	*t*	*df*	*p*	*d*
	M(SD)	*M(SD)*				
Age*	27.05(9.01)	26.04(4.65)	.46	29.02	.65	.14
BMI	23.79(3.84)	22.81(3.03)	.96	43	.34	.29
EAT-26*	36.48(13.63)	6.54(4.16)	9.68	23.26	< .001	3.06
BCQ*	78.10(16.68)	35.63(9.53)	10.29	30.88	< .001	3.18
DSED*	29.67(7.43)	14.04(4.27)	8.49	30.98	< .001	2.63

Note. BN = bulimia nervosa; HC = healthy controls; BMI = body mass index; EAT-26 = Eating Attitudes Test; BCQ = Body Checking Questionnaire; DSED = Distrust of the Senses in Eating Disorders scale.

*Equal variances not assumed

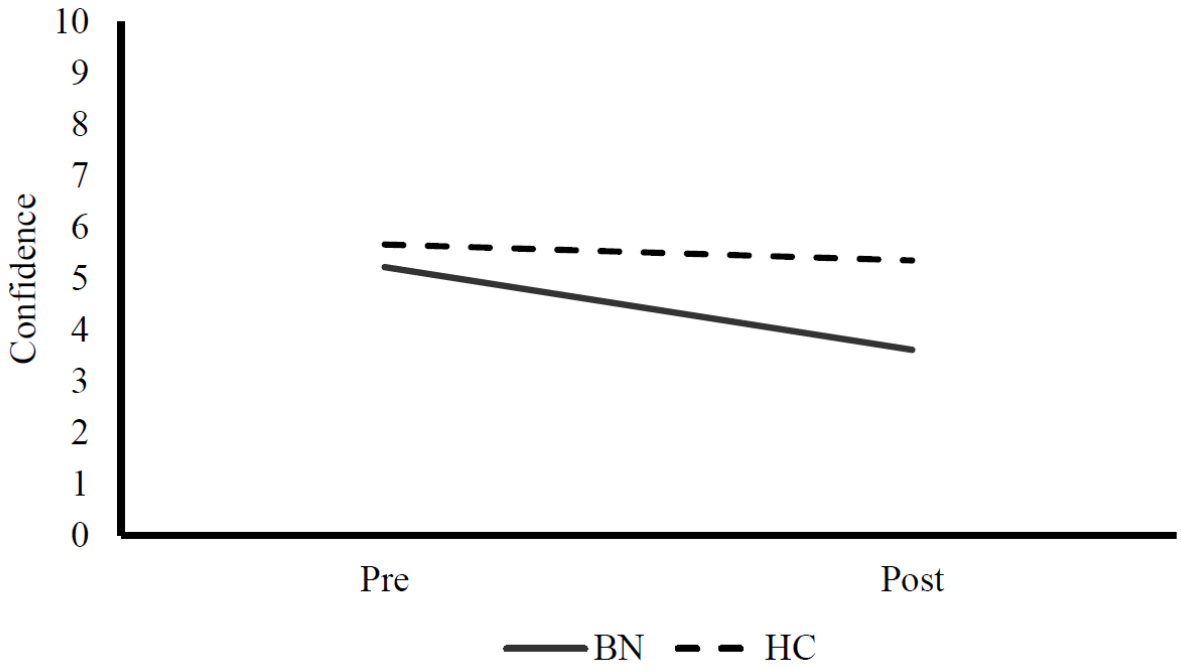

Figure 1. Perceptual confidence before and after a body checking task. Values depicted here represent untransformed values.

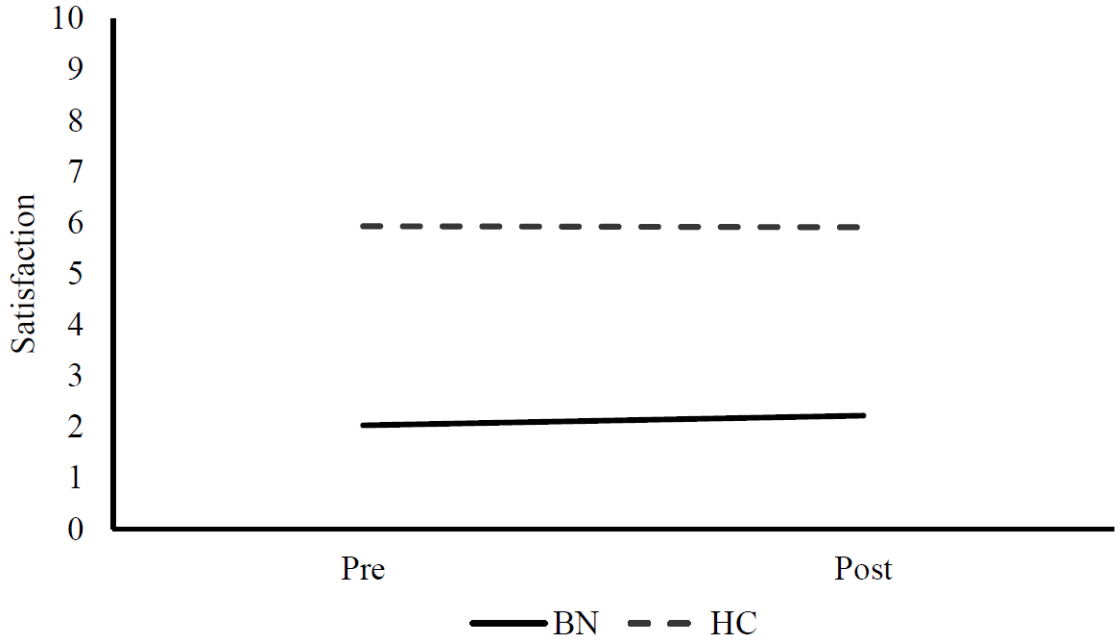

Figure 2. Body satisfaction before and after a body checking task. Values depicted here represent untransformed values.

General Discussion

Summary of objectives

The overarching objective of the present thesis was to examine the applicability of inferential confusion, a faulty inductive reasoning process that elicits doubt, to BN. The rationale behind the decision to devote this research project to the investigation of inferential confusion in BN, a construct typically associated with OCD, stems from the ever-growing body of research highlighting similarities between EDs and OCD. High rates of comorbidity (Godart et al., 2002) and familial relationships (Bienvenu et al., 2000) between these disorders, similarities in symptom expression (Formea & Burns, 1995; Pigott et al., 1991), and overlapping clinical features such as anxiety (Bulik, 1995), perfectionism, impulsivity (Altman & Shankman, 2009), and cognitive distortions (thought-fusion; Shafran & Robinson, 2004) support the relationship between OCD and EDs. Given these similarities, inferential confusion represented a relevant area of exploration as it continues the investigation of overlapping factors between OCD and EDs, and also addresses the lack of studies into reasoning in EDs. The potential relevance of investigating reasoning processes such as inferential confusion in BN is highlighted by several factors: theoretical accounts of the potential role of reasoning in EDs (Vitousek & Hollon, 1990; Aspen et al., 2013), an empirical study suggesting abnormalities in probabilistic reasoning in BN (Sternheim et al., 2011) similar to those previously observed in OCD (ex: Fear & Healy, 1997), and finally, an open clinical trial demonstrating the efficacy of a treatment targeting inferential confusion in a sample with BN (Purcell Lalonde & O'Connor, 2015). As such, the present thesis aimed to investigate the two components of inferential confusion: the over-investment in possibility-based information and distrust of the senses in a sample with BN.

Summary of findings

The present thesis provides self-report and experimental support for the role of inferential confusion as a whole in BN and tests each of its components individually.

Article 1. Drawing inspiration from the investigation of inferential confusion in OCD, the first thesis article evaluated this construct using a validated self-report measure (i.e., the ICQ-EV), and also employed an adapted inductive reasoning task (i.e., the RIAT) to evaluate one of the components of inferential confusion: the over-investment in possibility-based information. It was hypothesized that self-report inferential confusion on the ICQ-EV would be greater in the BN group as compared to the HC group. This hypothesis was supported by the mean score in the BN group as it was significantly higher than that obtained in the HC group. Furthermore, the mean score obtained in the BN group (M = 93.92; SD = 37.93) in the present study fell between that observed in an anxious control group (M = 87.69; SD = 36.93) and an OCD group (M = 109.84; SD = 34.88) reported in the original validation study of the ICQ-EV (Aardema et al., 2010). This is of particular note as the items of the ICQ-EV were conceptualized with OCD in mind and the content was not adapted for BN in the present study. It was also hypothesized that individuals with BN would over-invest in possibility-based information resulting in increased doubt toward an initial conclusion on a reasoning task. Results from the RIAT, a formal measure of inductive reasoning originally developed for use with OCD samples and adapted for BN, partially supported this hypothesis. Significant changes in confidence were observed in the BN group for both neutral (decreases in confidence) and BN-relevant (trend-level increases in confidence) items, but not in the HC group. Generally, this supports the notion that individuals with BN are more susceptible to over-investment in possibility-based information than are HC participants, which is in line

with previous research in OCD using the RIAT (Pélissier et al., 2009). Further research is needed to determine the impact of the content of the alternatives presented, that is, whether they support or contradict the realities of having BN. The first thesis article suggests the relevance of inferential confusion in BN and highlights its potential impact on reasoning.

Article 2. While in the first thesis article over-investment in possibility-based information was assessed using a formal measure of inductive reasoning, the second thesis article aimed to measure this component of inferential confusion using a more ecologically valid task (i.e., the IPT). The IPT conceptualizes doubt elicited by inferential confusion as a dynamic and ongoing process meant to resemble real-life reasoning in which a person has access to both reality-based and possibility-based information. As with the RIAT, the IPT employed in the present study was adapted from the original to include BN-relevant (as opposed to OCD-relevant) content. It was hypothesized that the BN group would be more influenced by possibility-based as compared to reality-based information and that this would result in increased investment in a possibility-based feared outcome. This hypothesis was supported in that the BN group evinced greater doubt at baseline, and also demonstrated greater fluctuation in doubt as a function of the type of information presented. These results indicate that individuals with BN were more easily immersed in a possibility-based narrative and were more influenced by possibility-based information even in the presence of reality-based information as compared to the HC group, which resulted in increased investment in a feared outcome. This pattern of results is in line with those obtained in OCD samples (Aardema et al., 2009; Nikodijevic et al., 2015), though it is of note that the significant baseline differences observed in the present study were not found by Aardema and colleagues (2009). In addition to the over-investment in possibility-based information as it pertains to a

feared possible outcome, the present study also evaluated over-investment in a feared possible self. Indeed, the BN group reported significantly greater fear of self than the HC group on a self-report questionnaire measuring this construct (i.e., the FSQ). Greater investment in a feared possible self has also been found in a heterogeneous ED group (Purcell Lalonde et al., 2015) as well as in OCD samples (Aardema et al., 2013; Nikodijevic et al., 2015). Furthermore, as has been found in OCD (Nikodijevic et al., 2015), greater fear of self was significantly associated with greater doubt and symptom severity. This lends support to the pervasiveness of a reasoning style characterized by the over-investment of possibility-based information leading to doubt regarding both feared outcomes and identities. Furthermore, the first and second thesis articles describe the first investigation, to our knowledge, of inductive reasoning in BN. This is of importance as these results highlight the clinical relevance of reasoning processes in BN.

Article 3. The third thesis article aimed to investigate the second component of inferential confusion: distrust of the senses. This is a complex construct comprising both low cognitive confidence as well as a tendency to go beyond the senses (into imagination). For the purposes of the present study, a subtype of cognitive confidence (i.e., perceptual confidence) was investigated. It was hypothesized that perseverative body checking would elicit decreases in perceptual confidence and body satisfaction in the BN, but not in the HC, group. These hypotheses were partially supported. Similar to what has been found previously using conceptually similar paradigms with OCD-relevant stimuli (ex: van den Hout, 2008), perceptual confidence in estimates of body size significantly decreased following perseverative body checking in the BN group while remaining stable in the HC group. Contrary to hypotheses, body satisfaction did not change in either group. As discussed in the

third article, this may be due to a floor effect (body satisfaction in the BN group was extremely low at baseline), or may point to the distinct nature of perceptual confidence and body satisfaction. Importantly, change in perceptual confidence was significantly correlated with ED symptomatology suggesting its clinical relevance in this population. Furthermore, results from a novel self-report questionnaire designed to assess general levels of perceptual confidence (i.e., the DSED) support the findings from the experimental task in that lower trait perceptual confidence was significantly associated with greater decreases in perceptual confidence following body checking. The DSED was also positively correlated with a measure of habitual body checking, again lending support to the findings of the experimental task suggesting that prolonged body checking is associated with low perceptual confidence. These results contribute to the understanding of the paradoxical effect of body checking in BN (see Meyer et al., 2011) through the identification of the potential role of low perceptual confidence in the maintenance of body checking. This pattern of findings is consistent with research into the effects of perseverative attending in OCD-relevant situations (ex: van den Hout et al., 2008). Furthermore, the third thesis article describes the first experimental investigation of perceptual confidence in BN. Importantly, the results concord with previous questionnaire-based studies finding reduced overall cognitive confidence in this population (ex: Davenport et al., 2015). Overall, the third thesis article elucidates the potential role of the distrust of the senses component of inferential confusion in the context of body checking, a common clinical behaviour.

Limitations and strengths

Several limitations should be considered when interpreting the results of this body of research. There are several limitations associated with the sample recruited for the present

study. Due to the nature of the research clinic (i.e., no treatment offered, no availability of medical follow-up, etc.) where the study was conducted, it was not considered feasible to recruit participants with AN, limiting the generalizability of the results. In line with the transdiagnostic model of EDs (Fairburn et al., 2003), however, it is believed that the results obtained would not have been significantly different in an AN group given the overlap in cognitive and behavioural processes postulated by this model. Furthermore, the recruitment of participants with BN as opposed to AN allowed for the evaluation of reasoning processes independent of the potential effects of low weight and starvation as well as contributed to the limited literature examining the relationship between BN and OCD. Indeed, though research tends to focus on the similarities between AN and OCD, some studies have suggested that the rate of comorbid OCD in BN samples is equivalent to that observed in AN samples (Kaye et al., 2004). In addition, other studies have suggested that certain variables of interest, such as body checking, are more prevalent in BN as compared to other ED subtypes (Kachani et al., 2014). Generalizability of the results is also limited by the exclusion of male participants, though this was deemed necessary as it was unlikely that there would be sufficient recruitment of males with BN to allow for gender-based comparison. The present sample also had high rates of comorbidity. This may dilute the relevance and specificity of the findings to BN. Analyses were conducted, however, to examine this possibility and the results suggest that the results obtained are independent of comorbidity. Furthermore, the inclusion of comorbidity increases the ecological validity of the sample as it is estimated that nearly all individuals with BN have some form of comorbidity (Hudson et al., 2007). Nevertheless, the potential impact of comorbidity should be kept in mind when considering the implications of the results pertaining to inferential confusion in BN.

With regards to the design of the present study, it should be noted that the lack of a clinical control group is an important limitation. Without a clinical control group, it is impossible to determine whether inferential confusion is specific to BN and OCD, or rather a product of anxiety, distress, and/or psychopathology. Also, the study is limited by the use of an online survey software for the administration of the questionnaires and reasoning tasks. Though this is an increasingly popular research tool facilitating participation, an online format precludes experimenter observation (ex: to ensure that it is actually the participant who completes the measures), the availability of the experimenter to respond to questions or provide clarification of instructions, and the homogeneity of the administration setting (ex: room free of distractions, etc.). Finally, the measures administered online were not randomized. Although there is no rationale to suspect an order effect, it is possible that the presentation of one questionnaire or reasoning task before another may have impacted the results. If this is the case, however, this effect is constant across participants and each reasoning task was analysed independently of the other.

As noted in each thesis article, there are also several limitations associated with each task. Generally, the reasoning and body checking tasks were not piloted or validated for EDs. The reasoning tasks were, however, validated as analogues of doubt as elicited by inferential confusion (Aardema et al., 2009; Pélissier et al., 2009) and the body checking task was designed with previously used measures in mind (Shafran et al., 2007; Smeets et al., 2011). More specific to the RIAT, this task was limited by the omission of items whose alternative possibilities support the initial conclusion (in the present study, all alternatives contradicted the initial conclusion), and also items where the initial conclusion was in line with ED thinking and the alternatives contradicted this (in the present study, all items had the opposite

format). The recognition of the lack of these item conditions echo a critique of the original RIAT used in OCD made by Gangemi and colleagues (2015). Though the format used in this version of the RIAT likely more closely resembles ED reasoning, it would be of interest to examine whether reasoning abnormalities are observed using this other item format (i.e., items in which the alternatives support the initial conclusion), especially in light of the significant results in the BN group for neutral items in the present study. Relatedly, the implications of the IPT are limited by the lack of a neutral scenario. Though one study using an OCD sample found null results using a neutral scenario (Aardema et al., 2009), another found a small (in comparison with the OCD-relevant scenarios) effect (Nikodijevic et al., 2015). Future research should explore reasoning and the over-investment in possibility-based information in BN in neutral conditions as well. Finally, the body checking task was limited by the absence of an objective measure of body size, which prevented the evaluation of body size estimation accuracy. This was done, however, to obtain an accurate measure of confidence without the influence of body dissatisfaction and distress caused by exposure to objective information (ex: learning the actual circumference of one's waist). Also, the absence of objective measurement more closely resembles common body checking behaviours (ex: staring in the mirror, etc.).

This research also includes important strengths that support the conclusions drawn from the observed results. Notably, all participants were recruited from the community. This helped to prevent the creation of a markedly low functioning clinical group (as can sometimes occur with sampling from specialized treatment units) and of an exceptionally high functioning HC group (as is often the case with undergraduate samples). Also, the use of a clinical group of women with BN allows for increased generalizability of the findings as compared to the use of analogue samples. Importantly, the use of both experimental and

questionnaire-based measures allows for convergent validity. Confidence in the results is strengthened as the effects observed on the experimental reasoning and body checking tasks are correlated with self-report indicators. The clinical relevance of the results is supported by associations with ED symptom severity.

Theoretical implications

IBA was initially developed as an etiological model of OCD, attributing the development of obsessions and the triggering of subsequent compulsions to the construction of a faulty inductive narrative characterised by doubt due to inferential confusion (O'Connor et al., 2005a). Recent research has found evidence to support the relevance of this construct in OCD spectrum and related disorders, with the suggestion that inferential confusion is a transdiagnostic process (O'Connor et al., in press). The results of the present body of research have important theoretical implications pertaining to the role of inferential confusion and doubt in BN. The first and second thesis articles demonstrated a tendency to invest in remote possibilities during reasoning as well as in a feared possible self, while the third thesis article provided evidence for low perceptual confidence, an indicator of distrust of the senses. The finding that individuals with BN endorse greater levels of inferential confusion on a self-report measure highlights how this construct corresponds to the subjective experience of those affected by this disorder as well as to their symptoms. Though research into inferential confusion in EDs has been limited, these results are coherent with those of previous studies demonstrating the efficacy of therapy targeting inferential confusion in BN (Purcell Lalonde & O'Connor, 2015), elevated levels of fear of self in EDs (Aardema et al., 2017; Purcell Lalonde et al., 2015), and low cognitive confidence in EDs (ex: Davenport et al., 2015). This pattern of results is similar to that which has been obtained in OCD samples and lends support to the

assertion that inferential confusion plays a role in BN. The identification of inferential confusion as a relevant process in BN is consistent with the view that this is a transdiagnostic construct. These findings also highlight the importance of going beyond disorder-specific content and considering underlying cognitive processes. This method allows for a more fundamental understanding of BN, of the complex relationship between BN and OCD, and also demonstrates the utility of transdiagnostic research.

This line of research also contributes to the ED literature independent of its implications for the IBA model. Experimental results supporting the over-investment in possibility-based information highlight abnormalities in inductive reasoning in BN, while also addressing the paucity of research into reasoning in EDs. This is coherent with other research reporting abnormal probabilistic reasoning characterized by excessive evidence gathering and doubt in BN (Sternheim et al., 2011). This pattern of findings also offers insight into how an individual at a low or normal weight can believe/fear (essentially, invest in the remote possibility) that they are currently or are at great risk for becoming overweight.

Results indicating elevated levels of fear of self in BN also contribute to literature pertaining to self-concept in EDs. EDs have consistently been associated with negative core beliefs about the self (see Jones, Leung, & Harris, 2007 for a review). Given the results of this and previous research pertaining to the fear of self, negative core beliefs about the self may be based on possibility (self-as-could-be) rather than on reality (self-as-is) (Aardema & O'Connor, 2007). Fear of self in EDs may also be linked to vulnerable self-themes as has been found in OCD. Research in OCD has demonstrated that domains that are valued, but in which an individual feels unconfident (i.e., vulnerable self-themes) can increase the risk for obsessions (ex: Doron et al., 2012). Previous research has established that experiences such as

weight-related teasing are associated with ED symptoms (ex: Keery, Boutelle, van den Berg, & Thompson, 2005). Such experiences reinforce the importance of appearance while diminishing the targeted person's sense of efficacy in this domain. Weight-related teasing, among other experiences and factors, may contribute to the development of vulnerable self-themes and investment in a feared possible self concerning eating, shape, and weight (ex: 'I might become overweight and teased again'). Differing life experiences and values contributing to the development of different vulnerable self-themes may help to explain, at least in part, why someone may develop BN, while another may develop OCD. The notion of vulnerable self-themes may also contribute to our understanding of the specificity of impairment in BN (i.e., why individuals with BN do not demonstrate impaired functioning outside of eating disorder-specific situations). It may be that the significant importance attributed to eating, shape, and weight, coupled with the perception that one is inadequate/incompetent in this regard, fosters inferential confusion and pathological behaviour in this specific area. Moreover, it may be worthwhile to give increased attention to fear of self and vulnerable self-themes when attempting to better understand the motivation behind ED behaviours. For example, individuals with EDs will often set ever-changing weight goals, with the target weight continuously decreasing. This highlights how the individual with an ED does not seem to be restricting or engaging in other weight-loss behaviours in an attempt to obtain something in particular, but rather is running away from something (i.e., a feared self). When a goal is defined by the absence of something (i.e., not becoming overweight) rather than the attainment of something (i.e., a weight of X), it is impossible to know when it has been achieved, thus motivating the person to perpetuate their efforts. A similar pattern is noted in OCD (see O'Connor & Robillard, 1995 for a description).

The results of the third thesis article have important implications for our understanding of body image. There are mixed findings regarding the existence of perceptual deficits in EDs (see Cash & Deagle, 1997 for a review), with some calling for a shift in focus to the cognitive factors underlying body image disturbance in EDs (Frank & Treasure, 2016). The present finding that perceptual confidence decreases following body checking is consistent with previous research indicating that body image fluctuates (ex: Cash, 2002) and that body image disturbance is triggered by different contexts, including body-focused situations (ex: Tiggeman, 2001). These results are contrary to the perceptual deficit hypothesis of EDs, suggesting that, similar to what has been found in OCD, low confidence rather than actual perceptual deficits may motivate compulsive body checking. These findings also suggest that previous studies finding support for perceptual deficits (see Cash & Deagle, 1997 for a review) were influenced by the body-focused nature of the tasks used. Indeed, methodology requiring perseverative attending to the body may elicit low perceptual confidence, which may better account for positive results on these tasks as opposed to deficits in perception. The impact of methodology in this domain requires further investigation. Furthermore, these results also have implications for our understanding of body checking, a behaviour that is performed to obtain reassurance, but ultimately leads to distress in the long-term (Meyer et al., 2011). Findings from the present thesis may elucidate this paradoxical relationship. As has been found in the OCD literature (ex: van den Hout et al., 2008), it may be that perseverative attending to the body, as is characteristic of body checking, leads to reduced perceptual confidence, which leads to increased distress (ex: 'I'm not sure if what I am seeing is accurate'). This may ultimately encourage continued body checking, resulting in a self-

maintaining cycle of body checking to gain reassurance about one's appearance, less confidence in one's ability to accurately perceive the body, and increased distress.

Clinical implications

The present results highlight the potential relevance of evaluating inferential confusion and related constructs (i.e., doubt, fear of self, perceptual confidence, etc.) in BN, and potentially, in other EDs. These constructs may also represent important treatment targets. Indeed, inferential confusion and other constructs investigated in the context of the present thesis may help in the conceptualization of ED symptomatology. For example, it may be that individuals with EDs distrust sensory information (ex: 'My clothes fit the same as before') and invest instead in remote possibilities (ex: 'What if I have gained weight and I just can't tell?') that correspond with a feared possible self (ex: 'I might become fat and unlovable'). This style of reasoning may reflect a narrative that encourages the person to act as if the possibilities generated by the imagination were true leading to pathological behaviours such as compensatory behaviours and repeated body checking. The outcomes of these behaviours are never satisfactory as these reality-based actions cannot resolve doubts originating from the imagination. Indeed, a possibility-based problem cannot be resolved with a reality-based solution. Inferential confusion may help to explain different clinical features of EDs (ex: fluctuations in body image, recognition of low/normal weight yet continued fear of being over-weight/weight gain, ever-changing 'target weight', etc.).

Although CBT-E (Fairburn et al., 2008) is the treatment of choice for BN, a significant proportion of individuals remain symptomatic following treatment (Fairburn & Harrison, 2003). This speaks to the need to identify additional core processes inherent to EDs, and also to develop novel treatment strategies. The results of the present thesis point to significance of

inferential confusion in BN, which may have important treatment implications. IBT is a form of treatment based on the IBA model that directly targets inferential confusion using a variety of cognitive techniques. IBT has been found to be as effective as standard CBT for OCD (see Julien et al., 2016 for a review), with some studies suggesting that it may be more effective than CBT for individuals with strong over-valued ideation (O'Connor et al., 2005b; Visser et al., 2015). This is of particular importance as EDs have also been associated with over-valued ideation (Steinglass et al., 2007), which may be a predictor of poor treatment outcome as has been found in the context of OCD (Abramowitz et al., 2005). Furthermore, a recent clinical trial found IBT adapted for EDs to be effective in the reduction of symptoms in a BN sample (Purcell Lalonde & O'Connor, 2015). Though there are significant theoretical differences between standard CBT and IBT conceptualizations, IBT techniques are compatible with CBT and can be used as an adjunct to this treatment modality. The IBT module addressing fear of self is compatible with the common practice of targeting the 'anorexic gremlin' or the 'ED voice' (Pugh & Waller, 2017) and may support the development of the client's authentic self or 'self-as-is'. Construction of the ED narrative and comparing it with a non-ED narrative for a given situation can be a highly individualized and in-depth complement to the identification of core beliefs and their alternatives. Also, the identification of reasoning errors within the ED narrative is compatible with psychoeducation regarding cognitive distortions. A discussion of doubt and its role in EDs represents an opportunity to evaluate and, if necessary, address cognitive confidence and beliefs about specific abilities (ex: perceptual abilities). For a detailed description of IBT adapted for BN, see Purcell Lalonde and colleagues (2016). Overall, there is preliminary evidence to suggest that IBT may be effective for BN and a

conceptual understanding of IBT techniques highlights how they may be applied within the framework of traditional CBT-E.

Future directions

Overall, the results of the present thesis suggest the significance of inferential confusion in BN. The preliminary nature of these findings as well as the limitations inherent to the study design underscore the importance of continued research in this area. Research conducted in OCD samples suggests that inferential confusion, its components, and the doubt it elicits can be reliably measured using self-report measures and experimental tasks. Similar patterns of results to what has been reported in OCD samples were found in the present study. Significant associations between indicators of inferential confusion and BN symptoms were also found. A next logical step would be to evaluate the degree to which inferential confusion is predictive of ED symptoms as well as to examine the relationship between this construct and other core ED processes as has been done in the context of OCD (Aardema et al., 2006; Aardema et al., 2008). Future research should also aim to employ large transdiagnostic ED samples that would not only provide additional support for the validity of the measures used in the present thesis, but would also permit subtype level analysis.

More broadly, future research into the potential causal role of inferential confusion in EDs may be warranted. The transdiagnostic model of EDs (Fairburn et al., 2003) is the most widely used model applied to this population and has received a great deal of empirical support for both its tenets (Hoiles, Egan, & Kane, 2012; Lampard, Byrne, McLean, & Fursland, 2011) as well as for the efficacy of treatment based on this model (Hay et al., 2009; Turner et al., 2015). This model identifies the preoccupation with eating, shape, and weight as the 'core psychopathology' of EDs and focuses primarily on the factors that maintain this

preoccupation. ED preoccupations are similar to obsessions in OCD in terms of the frequency of intrusive thoughts, emotional disturbance elicited, role of appraisals, and use of control strategies (Garcia-Soriano, Roncero, Perpina, & Belloch, 2011). This suggests that preoccupations in EDs may develop via similar processes as obsessions in OCD. IBA is an etiological model of OCD that posits that obsessions arise through the creation of faulty inductive narratives characterized by inferential confusion (O'Connor et al., 2005a). This model is not at odds with standard CBT models that highlight the importance of faulty appraisals of intrusions in OCD. The IBA model acknowledges the role of appraisals in OCD, but theorizes that the intrusive thought is rendered obsessional before it is misappraised. Indeed, according to IBA, intrusive thoughts as they occur in OCD are not 'normal' thoughts that are misappraised (though the content may somewhat resemble those of intrusions observed in the general population). Intrusive thoughts become obsessional when they are included in an internal narrative that is based in imagination and impervious to the present moment (i.e., characterized by inferential confusion). There is an increasing body of research supporting the IBA conceptualization of OCD, and to a lesser extent, its relevance to other OCD spectrum disorders (see Julien et al., 2016 for a review). Echoing research into OCD, ED preoccupations have been documented in non-clinical samples with those with greater dietary restraint experiencing a greater frequency of these intrusions (Perpina, Roncero, Belloch, & Sanchez-Reales, 2011). As in OCD, only a small proportion of individuals develop obsessional thoughts about eating, shape, and weight and engage in dangerous behaviours, which speaks to the importance of cognitive processes rather than content. Experimental research is currently underway to examine the effect of inferential confusion on behaviours in EDs (Ouellet-Courtois & O'Connor, in preparation). Additional studies should investigate the

causal role of inferential confusion in the development of preoccupations related to eating, shape, and weight in EDs.

Conclusions

In a recent paper discussing the future of ED research, Bulik (2016) highlights the critical importance of 'reducing isolationism' and of the integration of research from other related fields. In light of the epidemiological and phenomenological relationship between EDs and OCD, the OCD literature represents a potential guide to the discovery of novel processes relevant to EDs. It has been suggested that EDs belong on the obsessive-compulsive spectrum (ex: Bartz & Hollander, 2006) and more specifically, it has been concluded that the cognitive style of EDs is similar to that of obsessive-compulsive spectrum disorders (Treasure, 2006). Despite calls for research into cognitive processes in EDs (Frank & Treasure, 2016) and theoretical accounts of the potential importance of reasoning processes in this population (Vitousek & Hollon, 1990), research of this kind has lagged behind that conducted in the context of other disorders like OCD. The present body of work unites research done in the field of OCD with the need for this type of research in the area of BN. Overall, inferential confusion represents a promising avenue for research into the cognitive processes underlying ED psychopathology.

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Appendices

Appendix A: Ethics Certificate

Institut universitaire
en santé mentale
de Montréal

Le 22 juillet 2015

Madame Samantha Wilson
Centre de recherche
de l'Institut universitaire en santé mentale de Montréal

Objet : Approbation finale du Comité d'éthique de la recherche
Projet n^{o} 2016-240 - Le rôle du doute dans la boulimie

Madame Wilson,

Le Comité d'éthique de la recherche de l'Institut universitaire en santé mentale de Montréal, a passé en revue, en comité restreint, les documents suivants :

- Autorisation départementale / directeur de recherche (ExamenOraleReussie.pdf)
- Budget (CRFS HLHL_20150521_155320.pdf)
- Protocole de recherche (Doubt_in_BN_Ethics_Submission.pdf)
- Formulaire d'information et de consentement (ConsentForm_DoubtBN_1.pdf)
- Formulaire d'information et de consentement (ConsentForm_DoubtBN_1_EN.pdf)
- Questionnaire (DSBN_EN.pdf)
- Questionnaire (DSBN_FR.pdf)
- Recrutement (annonce_BN_FR.pdf)
- Recrutement (annonce_healthycontrols_FR.pdf)
- Recrutement (annonce_healthycontrols_EN.pdf)
- Recrutement (annonce_BN_EN.pdf)
- Questionnaire (IPT-BN_EN.pdf)
- Questionnaire (IPT-BN_FR.pdf)
- Questionnaire (PhoneScreen.pdf
- Questionnaire (RIAT-BN_EN.pdf)
- Questionnaire (RIAT-BN_FR.pdf)
- Questionnaire (VAS_BodyDissatisfaction_EN.pdf)
- Questionnaire (VAS_BodyDissatisfaction_FR.pdf)
- Questionnaire (VAS_EstimatesConfidence_EN.pdf)
- Questionnaire (VAS_EstimatesConfidence_FR.pdf)

Le CÉR approuve les modifications qui ont été apportées aux documents mentionnés ci-dessus, tel que suggéré par le comité dans son Formulaire 20-2757 "Réponse aux recommandations".

J'ai le plaisir de vous informer que votre projet est approuvé par le Comité d'éthique de la recherche. La présente décision vaut pour une année à partir de la date de la présente lettre.

Au terme de ce délai, un rapport doit être soumis au comité d'éthique en guise de rapport final, si le projet est réalisé en moins d'un an ou en guise de rapport annuel pour le projet se poursuivant sur plus d'une année. Dans ce dernier cas, le rapport annuel permettra au comité de se prononcer sur le renouvellement du certificat d'approbation éthique.

Toute modification au protocole de recherche en cours, de même que tout événement ou renseignement pouvant affecter l'intégrité de la recherche doivent être communiqués rapidement au comité d'éthique.

La suspension ou la cessation de votre projet, temporaire ou définitive, doit être communiquée au comité d'éthique dans les meilleurs délais.

En terminant, je tiens à vous informer que la présente décision a été rendue alors que le quorum était atteint.

Je vous prie d'agréer, madame Wilson, mes meilleures salutations.

[redacted]

Me Odette Beaudoin, présidente
Comité d'éthique de la recherche
CIUSSS de l'Est-de-l'Île-de-Montréal
Institut universitaire en santé mentale de Montréal

/kl

Appendix B: Consent Form

Centre intégré universitaire de santé et de services sociaux de l'Est-de-l'Île-de-Montréal
Québec

Institut universitaire en santé mentale de Montréal

Centre d'études troubles obsessionnels-compulsifs et tics
tictactoc.org

INFORMATION AND CONSENT FORM

The Role of Doubt in Bulimia

Principal researcher:	Samantha Wilson, PhD candidate in clinical psychology at l'Université de Montréal
Research supervisors:	Kieron O'Connor, PhD., Researcher at Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CRIUSSM) du Centre intégré universitaire de santé et de services sociaux (CIUSSS) de l'Est-de-l'Île-de-Montréal Frederick Aardema, PhD., Researcher au Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CRIUSMM) du Centre intégré universitaire de santé et de services sociaux (CIUSSS) de l'Est-de-l'Île-de-Montréal

Funding sources: The researcher funds of Dr. Kieron O'Connor, psychologist

PREAMBLE

We are asking for your consent to participate in a research project. Before accepting to participate and signing this information and consent form, please take the time to read, understand, and carefully consider the information presented.

This form may contain words that you do not understand. We invite you to ask any questions that you may have to the researcher responsible for this project or other members of the research team. Please ask them to explain any word or piece of information that is unclear.

PART I: DESCRIPTION OF THE PROJECT

The main goal of this project is to understand the reasoning style of individuals suffering from bulimia and the impact of this reasoning style on body image and the severity of bulimic symptoms. To accomplish this goal, we will administer questionnaires, do a task in front of a mirror, and conduct interviews with 25 women suffering from bulimia and 25 women who are not suffering from bulimia (and who do not suffer from any form of mental illness).

Your participation in this research project will be divided into two phases and involves:

1. For all participants: Fill out questionnaires online that ask about your eating habits, body image, level of anxiety, and that evaluate your reasoning style. This will take approximately two hours. Once the online questions are complete, the student

researcher (Samantha Wilson) will contact you by telephone to schedule an appointment for the second phase of the study.

2. An in-person appointment at the Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CRIUSMM). With the student researcher:
    a. The participants without bulimia (control group) will complete with the researcher:
        i. an interview about your eating habits
        ii. a task in front of the mirror
        iii. measurement of your height and weight to determine body mass index (BMI)

        This appointment will last 1.5 hours making the total participation in this study 3.5 hours.

    b. Participants with **BULIMIA** will complete with the researcher:
        i. an interview about your eating habits
        ii. a semi-structured interview about other psychological symptoms
        iii. a task in front of the mirror
        iv. measurement of your height and weight to determine body mass index (BMI)

        This appointment will last 2.5 hours making the total participation in this study 4.5 hours.

The interviews and task in front of the mirror will be audio recorded for later analysis.

RISKS

There are no major foreseeable risks associated with your participation in this research project.

POTENTIAL INCONVENIENCES AS A RESULT OF PARTICIPATION IN THE RESEARCH PROJECT

There are no inconveniences associated with your participation in this research project other than the time necessary to complete the questionnaires. It is possible that certain questions or the task in front of the mirror may provoke unpleasant emotions or anxiety. These reactions are temporary and are part of the evaluation and experimentation process. In the case of an undesirable reaction, the situation will be addressed by one of the members of the research team. Also, you can always choose to not answer a question or choose to terminate your participation at any time, without any negative consequences to you.

POTENTIAL ADVANTAGES AS A RESULT OF PARTICIPATION IN THE RESEARCH PROJECT

You will be contributing to the advancement and development of knowledge concerning bulimia.

COMPENSATION

Participants suffering from bulimia will receive $50 for their participation. Participants in the group without bulimia will receive $30 for their participation. Participants who only complete the first phase of the study (i.e., the online questionnaires) will receive $15 for their participation.

CONFIDENTIALITY

The observed data collected as well as the results of the questionnaires will be treated confidentially, and your file will be coded with a number. The paper documents will be kept together in a filing cabinet under lock and key, and the electronic data will be integrated into a secure, password protected database. Only the members of the research team will have access to the denominalized (i.e., your name will not be accessible) results. The paper documents will be stored under lock and key, for a period of 25 years after the end of the present study, at the Centre de recherche de l'Institut universitaire en santé mentale de Montréal (CRIUSMM), situated at:

7331 Hochelaga

The results of the present study may serve as the basis for scientific publications, which will respect the rules of confidentiality. No publication or scientific communication will contain anything that could lead anyone to identify you.

The data collected for this study will be kept on servers located at l'Institut universitaire en santé mentale de Montréal (IUSMM). Only the researchers named above as well as authorized IUSMM personnel will have access to the data, and they will require a password to access it and the master list to identify you.

We cannot guarantee the confidentiality of data collected via the online survey software used in the first phase of the study (SurveyMonkey) as it is subject to the privacy policy of this company. That said, your names will not be associated with your questionnaire responses, but rather an ID number will be used to identify you in this software. Only the researcher will have a password protected master list linking your name to your ID number.

VOLUNTARY PARTICIPATION AND RIGHT TO CEASE PARTICIPATION

Your participation in this study is completely voluntary. You are free to accept or to refuse to participate without needing to provide reasons for your decision. You can cease your

participation at any moment by informing a member of the research team. Upon your request, any data associated with your participation (collected from questionnaires, interviews, or audio recording) can be destroyed. Your decision to not participate in this study or to cease participation will not result in any negative consequences for you or any services that you are receiving.

INDEMNIFICATION IN CASE OF HARM AND THE RIGHTS OF THE RESEARCH PARTICIPANT

If you are harmed in any way due to your participation in this research project, you will receive all of the care and access to services necessary for your health, without cost to you. By accepting to participate in this study, you do not renounce any of your rights or free any of the implicated researchers, organizations, enterprises, or institutions of their legal and professional responsibilities.

RESOURCE CONTACTS

For any questions related to the study or any problem associated with my participation in the study, I know that I can contact the principal researcher, the supervisor of this research project, or the coordinator of this project:

Samantha Wilson, principal researcher
(514) 251-4000 ext: 3532
samantha.wilson@umontreal.ca

Kieron O'Connor, research supervisor
(514) 251-4015 ext: 2343
Kieron.oconnor@umontreal.ca

Karine Bergeron, research coordinator
514-251-4015 ext: 3585
Kbergeron.iusmm@ssss.gouv.qc.ca

For all questions concerning your rights as a research participant or any ethical issues pertaining to the conditions of your participation in this project, you can contact:

IUSMM
CIUSSS de l'Est-de-l'Île-de-Montréal
7401, rue Hochelaga - Montréal (Québec) H1N 3M5
Telephone: (514) 251-4000 ext: 2920
Fax: 514-251-2964

The research ethics committee of the IUSMM du CIUSSS de l'Est-de-l'Île-de-Montréal has approved this research project and will monitor it throughout. Furthermore, any revision or change to the information and consent form or to the research protocol must be approved beforehand by this committee. With regards to this, you may contact:

IUSMM
CIUSSS de l'Est-de-l'Île-de-Montréal
7401 rue Hochelaga, Montréal, QC, H1N 3M5
Telephone: 514-251-4015, poste 2442
Fax: 514-251-2964
comiteethiquerecherche.iusmm@ssss.gouv.qc.ca

PART II: CONSENT

PARTICIPANT SIGNATURE

I declare that I have read the present information and consent form, and have taken note of the information pertaining to the nature of my participation in the research project and of any risks that may result therein. I acknowledge that that the research project has been explained to me, that my questions have been answered, and I have been given enough time to make a decision.
I consent freely and voluntarily to participate in this project. I will be given a dated and signed copy of this information and consent form. This form will be placed in my research file.

Electronic Consent
I accept to participate ☐ I do not accept to participate ☐

Written consent to be obtained in person at the Centre de recherche de l'Institut universitaire en santé mentale de Montréal

Name of participant: _____
(in block letters)

Signature of participant: _____

Date: _____/_____/_____
day month year

SIGNATURE OF THE RESEARCHER OR A REPRESENTATIVE

The participant was able to ask all of the questions that were important to them and I answered all of these questions in good faith and with complete honesty. I reminded the participant that they were free to withdraw their participation at any moment, and without prejudice.

Name of the researcher or a representative: _____
(in block letters)

Signature of the researcher or a representative: _____

Date: _____/_____/_____
day month year

AUTHORIZATION OF AUDIO RECORDING

I understand that audio will be recorded for later analysis by a member of the research team. The purpose of these recordings have been explained to me. I have had the chance to ask questions and these have been answered in a manner that is satisfactory. I am satisfied with their guarantee that these recordings will be kept confidential. Upon reflection, I accept that audio will be recorded, but I retain my right to ask at any time that the recordings be destroyed. I also understand that it will not be possible to destroy the encoded data once it is transcribed.

Electronic Consent

I accept to be audio recorded ☐ I do not accept to be audio recorded ☐

Written consent to be obtained in person at the Centre de recherche de l'Institut universitaire en santé mentale de Montréal

Name of participant: _____
(in block letters)

Signature of participant: _____

Date: _____/_____/_____
day month year

Appendix C: Body Checking Task

Body Checking Task Protocol

Confidence in Estimations Rating Scale

Body Satisfaction Rating Scale

Body Checking Task Protocol

Location: Room with a double mirror. A line for participants to stand behind is indicated on the floor to ensure an equal distance from the mirror. Participants will be asked to remove any baggy sweaters (they were warned over the phone to wear a t-shirt underneath any baggy clothing).

Introduction: Now we will do a body size estimation task. The purpose of this task is to evaluate your ability to accurately estimate the size of certain body parts.

Part 1:

Experimenter: Please stand behind this line. I will tell you when to begin looking at your arms and also when to stop. You may just look at them or also touch them during this time. You may begin.

*Participant looks at arms for 15 seconds

Experimenter: Stop. Please tell me what you think the circumference of your arm is.

*Experimenter writes the estimate on the Confidence in Estimations Rating Scale

Experimenter: Now, I will tell you when to begin looking at your stomach and also when to stop. You may just look at it or also touch it during this time. You may begin.

*Participant looks at stomach for 15 seconds

Experimenter: Stop. Please tell me what you think the circumference of your stomach is.

*Experimenter writes the estimate on the Confidence in Estimations Rating Scale

Experimenter: Now, I will tell you when to begin looking at your hips and also when to stop. You may just look at them or also touch them during this time. You may begin.

*Participant looks at hips for 15 seconds

Experimenter: Stop. Please tell me what you think the circumference of your hips are.

*Experimenter writes the estimate on the Confidence in Estimations Rating Scale

Experimenter: Now, I will tell you when to begin looking at your thighs and also when to stop. You may just look at them or also touch them during this time. You may begin.

*Participant looks at thighs for 15 seconds

Experimenter: Stop. Please tell me what you think the circumference of your thighs are.

*Experimenter writes the estimate on the Confidence in Estimations Rating Scale

*Participant complete the Confidence in Estimations Rating Scale and the Body Satisfaction Rating Scale

Part 2:

*Experimenter looks at the Body Satisfaction Rating Scale to see which body part the participant is most dissatisfied with

Experimenter: Please stand behind this line again and face the mirror. For the next 10 minutes, please examine and check your (body part) in the mirror to get more information about it. You may look at it from different angles, touch it, and/or sit down in this chair to see how (body part) looks when you sit. I will be in the other room. If you wish to stop or have any questions, please knock on the mirror.

*Experimenter leaves the room and monitors the participant for distress from behind the (double) mirror

*Participant engages in body checking for 10 minutes

*Experimenter returns to the room

*Participant completes the Confidence in Estimations Rating Scale and the Body Satisfaction Rating Scale

Debriefing:

Experimenter: This task was designed to highlight a specific body part. But it is important to remember that this is not how it usually appears, when we typically look at ourselves or when other people look at you, they don't just see one body part, but look at us as a whole. This task simulated how it feels to selectively look at a single body part, and demonstrates how it can appear differently than when looking at it normally. This type of task has been used by other researchers to evaluate selective looking and understand the difference between selective and normal looking.

Now that your participation in this study is complete, I would just like to give you some more information about project in general. First of all, thank you for participating. The general purpose of this study was to investigate the role of doubt in bulimia in the hopes of better understanding why individuals with bulimia doubt certain things about the effects of eating or their appearance. We created the reasoning tasks and body checking task because we wanted to see to what extent you were susceptible to doubt things that appeared to be right or reasonable, and what factors influenced this process. In doing this, we hope to find out why some people are more likely to invest emotions and time in doubting things, like their appearance. These elements have already been investigated in obsessional preoccupations and have been found in this context. Given the similarities that exist between obsessional

preoccupations and bulimia, we chose to investigate whether doubt was relevant in bulimia as well. It is hoped that studies of this kind will help us to better understand bulimia, and ideally, help us to design more effective treatments for this disorder in the future. Thank you again for your participation in this study, we appreciate the time you invested in contributing to this research project. Do you have any questions? Should you think of any questions later, please do not hesitate to contact us.

*Participant is evaluated for distress and is offered a list of resources for eating disorders

Note. *Denotes action

Confidence in Estimations Rating Scale

Please rate your level of confidence in your estimation of the size of your **arms** by placing an "X" on the line.

_____

1 10

Not at all confident Extremely confident

Please rate your level of confidence in your estimation of the size of your **stomach** by placing an "X" on the line.

_____

1 10

Not at all confident Extremely confident

Please rate your level of confidence in your estimation of the size of your **hips** by placing an "X" on the line.

_____

1 10

Not at all confident Extremely confident

Please rate your level of confidence in your estimation of the size of your **thighs** by placing an "X" on the line.

_____

1 10

Not at all confident Extremely confident

Body Satisfaction Rating Scale

Please rate your level of satisfaction regarding your **arms** by placing an "X" on the line.

_____

1 10

Very unsatisfied Very satisfied

Please rate your level of satisfaction regarding your **stomach** by placing an "X" on the line.

_____

1 10

Very unsatisfied Very satisfied

Please rate your level of satisfaction regarding your **hips** by placing an "X" on the line.

_____

1 10

Very unsatisfied Very satisfied

Please rate your level of satisfaction regarding your **thighs** by placing an "X" on the line.

_____

1 10

Very unsatisfied Very satisfied

Appendix D: Reasoning Tasks

Reasoning with Inductive Arguments Task (RIAT-BN)

Inference Processes Task (IPT-BN)

Reasoning with Inductive Arguments Task (RIAT-BN)

Instructions: Please read the following statements and rate your degree of confidence in the subsequent conclusion.

Please read these alternate conclusions and rate your degree of confidence in the initial conclusion once again.

Please enter a value between 0 and 100%.

1)
You are looking in the mirror.
Earlier this morning, you ate a big stack of pancakes.

Conclusion: You will be happy with your reflection and satisfied with your tasty breakfast

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will feel like you have gained weight
Maybe you will notice your stomach looks bloated
Maybe you will decide to not eat for the rest of the day

Now, what is your degree of confidence with regards to the first conclusion? ____%

2)
It has been raining a lot since the beginning of the day.
You planned to go to a backyard party in the afternoon.

Conclusion: You decide not to go because the party is likely to be cancelled

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will go to the party anyway, in spite of the rain
Perhaps the party may take place under tents
Maybe you will decide to have people over at your house instead

Now, what is your degree of confidence with regards to the first conclusion? ____%

3)
A friend tells you that you look slim today.
You wonder what you meant.

Conclusion: You conclude the comment was a compliment

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will conclude the comment was a way to tell you that you looked fat yesterday
Maybe you will think your friend was warning you to be careful with what you eat
Perhaps you will work harder to maintain your current diet, as it seems to be working

Now, what is your degree of confidence with regards to the first conclusion? ____%

4)
You must get to a soccer game in which your team is participating.
You sprained your ankle two weeks ago.

Conclusion: You decide you will play anyway, despite this recent injury

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will go to the game to at least cheer on your team
Maybe you will go to help your coach with his responsibilities
Maybe you will have to postpone playing soccer to next summer because of this injury

Now, what is your degree of confidence with regards to the first conclusion? ____%

5)
You get out of bed and prepare to go to work.
You feel hungry.

Conclusion: You eat a bowl of cereal

What is your degree of confidence in this conclusion? ____%
Other conclusions:

Perhaps you will wait until lunch to eat something
Maybe you will ignore the feeling of hunger
Maybe you will skip breakfast as you are trying to restrict your calories

Now, what is your degree of confidence with regards to the first conclusion? ____%

6)
You have been working very hard lately.
You decide to take the afternoon off.

Conclusion: You decide to catch up on your housework

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will go for a walk in the park
Maybe you will go see a movie
Maybe you will go shopping

Now, what is your degree of confidence with regards to the first conclusion? ____%

7)
You are on a diet and so can only eat certain foods.
A friend suggests that you go out for lunch together.

Conclusion: You agree to go out and be less strict with your diet today

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will agree to go out, but be very selective about what you eat
Maybe you will agree to go out, but will just have coffee
Maybe you will decline the invitation

Now, what is your degree of confidence with regards to the first conclusion? ____%

8)
You decide to go fishing up at the lake.
You notice that it is very cold.

Conclusion: You decide to go back to get a sweater before returning to the lake

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will decide to take shelter in a cabin not far from the lake
Maybe you see that the weather is changing and becoming warmer
Maybe you will see that another fisherman has a spare coat to lend you

Now, what is your degree of confidence with regards to the first conclusion? ____%

9)
You are out for a walk during lunch hour.
You see many restaurants where you would like to eat.

Conclusion: You stop and get lunch somewhere

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will stop and buy a snack
Maybe you will eat the carrot sticks you packed for lunch
Maybe you will exercise during your lunch hour

Now, what is your degree of confidence with regards to the first conclusion? ____%

10)
You have to catch a train.
You are running late.

Conclusion: You decide to take a taxi to give you enough time to get there

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Perhaps you know that usually the train is delayed so you don`t have to rush
Maybe there will be traffic making you even more late
Maybe you will calculate that you can walk to the station with just enough time to spare

Now, what is your degree of confidence with regards to the first conclusion? ____%

11)
On Mondays you always go to the gym.
An important appointment is scheduled for this Monday.

Conclusion: You are happy to get a day off from the gym

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will go to the gym after your appointment even though you won't have enough time to do your complete workout
Maybe you will workout twice as hard on Tuesday to make up for the lost day

Maybe you will cancel your appointment to maintain your workout schedule

Now, what is your degree of confidence with regards to the first conclusion? ____%

12)
You are out for a walk.
It begins to rain lightly.

Conclusion: You decide to continue your walk despite the weather

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will notice your raincoat has a tear in it
Perhaps you will take cover in a nearby coffee shop until the rain stops
Maybe you will return home to get out of the rain

Now, what is your degree of confidence with regards to the first conclusion? ____%

13)
You are eating your lunch at work.
You see a co-worker glance in your direction.

Conclusion: You invite your co-worker to join you so that you can eat together

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Perhaps you will continue to eat on your own, but wonder about your portion size
Maybe you will only eat half of your lunch, just in case you have packed too much
Maybe you will stop eating, your co-worker must think you are a pig

Now, what is your degree of confidence with regards to the first conclusion? ____%

14)
You have a lot of work to do.
You have a very big project due tomorrow.

Conclusion: You stay up all night to complete this project

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will start working on it as soon as possible
Perhaps you will decide to share the work with a colleague
Maybe you will take your time and decide to ask for an extension

Now, what is your degree of confidence with regards to the first conclusion? ____%

15)
You are preparing dinner.
You know the caloric content of each ingredient.

Conclusion: You disregard the caloric information when deciding which ingredients to use, instead using those which taste best

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will try to choose some low calorie ingredients to make your meal healthier
Maybe you will prepare the lowest calorie meal possible
Maybe you will forget about dinner, everything has too many calories

Now, what is your degree of confidence with regards to the first conclusion? ____%

16)
You have an older laptop that you use quite frequently.
It has started to make an unusual noise.

Conclusion: You decide you will buy a new laptop

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will bring it to a store to investigate the meaning of the noise
Perhaps you will ask a tech-savvy friend for their advice
Maybe you will back up your data to another computer, just in case

Now, what is your degree of confidence with regards to the first conclusion? ____

17)
You weighed yourself this morning.
You gained 2lbs.

Conclusion: You conclude that no one will notice

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will try to make healthier choices at meal times
Maybe you will spend the entire day exercising
Maybe you will feel that others will judge you for your weight gain

Now, what is your degree of confidence with regards to the first conclusion? ____%

18)
You get home from a long day at work.
You lay down on the couch.

Conclusion: You fall asleep immediately

What is your degree of confidence in this conclusion? ____%

Other conclusions:

Maybe you will pick up a book and read for awhile
Perhaps you prefer to relax and meditate
Maybe you will turn on the television

Now, what is your degree of confidence with regards to the first conclusion? ____%

Inference Processes Task (IPT-BN)

Instructions: Each section of the following questionnaire starts out with a particular situation or scenario. Read each of the scenario's carefully and *imagine yourself as vividly as possible in that particular situation*. Following each scenario, you will be asked a number of questions about your thoughts and feelings with respect to the situation outlined in the scenario. Next, you will be given additional information for each scenario, and will be asked again to assess the situation taking into account the new information. There is no "right" or "wrong" answer so please answer the questions as if you were actually in the situation.

Scenario 1: You are driving a close friend home in your car. Before leaving your house, you saw a news report on television about someone who weighed 600lbs and had to be cut out of their home. You wonder how it is possible that someone could lose control over their eating to that extent and put themselves in such a position. As you drive along, you see a fast-food restaurant and smell the aroma of greasy food. It is lunch time and you have not eaten anything else all day. Your stomach begins to growl and you have a sudden craving for fast-food. You and your friend make the decision to enter the restaurant and purchase a meal.

Please answer the following questions (circle the number that best corresponds to your choice):

1A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

1B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

1C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You look down at your body and see that it is the same size as before

2A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

2B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

2C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

It may be that you just can't tell how much weight you've gained because you are wearing loose clothing

3A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

3B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

3C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You pinch your stomach and do not feel any fat

4A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

4B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

4C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

It is possible that all of the fat was added to your butt

5A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

5B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

5C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You ask your friend if you have gained any weight and she says "No, of course not!"

6A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

6B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

6C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Maybe she thinks the opposite but doesn't want to say it

7A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely | A little unlikely | Somewhat likely | Quite likely | Very likely | Extremely likely

7B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious | A little anxious | Somewhat anxious | Quite anxious | Very anxious | Extremely anxious

7C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You look over at your friend and see that she does not look fat even though she ate the same fast-food meal as you

8A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

8B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

8C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Maybe your friend did gain weight, but she was thinner than you from the start and so does not look fat, but you do

9A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

9B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

9C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You had an average sized meal at the restaurant

10A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

10B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

10C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Maybe just the fact that you are eating fast food means you are prone to lose control over what you eat

10A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

10B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

10C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You usually eat very healthy foods and only rarely have fast-food

12A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

12B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

12C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Eating fast-food is how people become obese, it may happen to you now

13A: Using the following scale, what do you consider to be the *likelihood* that you have gained weight after eating this meal?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

13B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

13C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Scenario 2: You are getting ready to go out with friends. You spent the day reading magazines, all of which emphasized the importance of having a "bikini-ready body" for the summer. On the way to meet up with everyone, you wonder what is considered bikini-ready and think about how horrible it would be to be seen wearing a bathing suit that showed any fat. When you meet up with your friends they introduce you to some new people. Everyone in the group is very well-dressed and physically fit. They were discussing their favourite work-out routines as you arrived. While speaking to one of your friends, you notice one of the other girls looking at your body.

Please answer the following questions (circle the number that best corresponds to your choice):

1A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

1B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

1C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

The other girl had neutral look on her face, not a look of disgust

2A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

2B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

2C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Maybe she was trying to control her facial expression to be polite, but really she may have shocked that you would wear that outfit at your current weight

3A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

3B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

3C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Your friend said that your outfit looks great

4A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely | A little unlikely | Somewhat likely | Quite likely | Very likely | Extremely likely

4B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious | A little anxious | Somewhat anxious | Quite anxious | Very anxious | Extremely anxious

4C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

She may have been trying to be nice, or meant that the outfit looked good, but not you in it

5A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

5B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

5C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You have worn this outfit in the past and received many compliments on your body

6A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely | A little unlikely | Somewhat likely | Quite likely | Very likely | Extremely likely

6B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious | A little anxious | Somewhat anxious | Quite anxious | Very anxious | Extremely anxious

6C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Maybe you have gained a lot of weight since you last wore this outfit

7A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely | A little unlikely | Somewhat likely | Quite likely | Very likely | Extremely likely

7B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious | A little anxious | Somewhat anxious | Quite anxious | Very anxious | Extremely anxious

7C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You see your reflection in the window of a nearby store and
see that your stomach is not sticking out

8A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

8B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

8C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You may not have seen your stomach correctly in the window, perhaps it looks much larger from another angle

9A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

9B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

9C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You tug on the waistband of your pants and see that you have plenty of extra room

10A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

10B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

10C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

It may be that your butt or thighs are the parts that look fat

11A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

11B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

11C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

You compare your body to the bodies of the other girls in the group and see that you are smaller than they are

12A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

12B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

12C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Please rate the questions again while considering the previous and following piece of information:

Your fat may be even more noticeable because you have a smaller frame

13A: Using the following scale, what do you consider to be the *likelihood* that the other girl thinks you're overweight?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all likely	A little unlikely	Somewhat likely	Quite likely	Very likely	Extremely likely

13B: Using the following scale, how much anxiety would you feel under these circumstances?

0-------10--------20--------30------40-------50-------60------70-----80------90------100

Not at all anxious	A little anxious	Somewhat anxious	Quite anxious	Very anxious	Extremely anxious

13C: Under these circumstances, would you feel the need to do something to ensure that you have not gained weight?

Yes ☐ No ☐

Appendix E: Questionnaires

Distrust of the Senses in Eating Disorders Scale (DSED)

Fear of Self Questionnaire (FSQ)

Inferential Confusion Questionnaire – Expanded Version (ICQ-EV)

Distrust of the Senses in Eating Disorders (DSED)

To what extent do you doubt the following statements?

1 = I do not doubt this at all
2 = I doubt this slightly
3 = I doubt this moderately
4 = I doubt this strongly
5 = I doubt this very strongly

1) The way I perceive my body when I look in the mirror is accurate.....1 2 3 4 5

2) I can tell when I feel hungry.....1 2 3 4 5

3) The number I see on the scale is accurate.....1 2 3 4 5

4) I can sense when my body is full.....1 2 3 4 5

5) Others are sincere when they compliment my appearance.....1 2 3 4 5

6) If my pants still fit like before, I accept that I have not gained any weight.....1 2 3 4 5

7) I can tell how big a body part is by touching it.....1 2 3 4 5

8) I recognize my body's hunger signals.....1 2 3 4 5

9) When I am eating, I can feel when I should stop.....1 2 3 4 5

10) I trust that I am able to see what I look like in reality.....1 2 3 4 5

Fear of Self Questionnaire (FSQ)

Please rate your agreement or disagreement with the following statements using this scale.

Scale: 1 2 3 4 5 6

Strongly disagree	Disagree	Somewhat disagree	Agree	Somewhat agree	Strongly agree

1. I often question my own character…….....1 2 3 4 5 6

2. It requires constant attention to ensure I am thinking and behaving appropriately.
…….....1 2 3 4 5 6

3. I often worry about what my inner thoughts might reveal about my character.
…….....1 2 3 4 5 6

4. I fear perhaps being a violent, crazy person…….....1 2 3 4 5 6

5. I can easily imagine myself as the kind of person that should definitely feel guilty.
.....1 2 3 4 5 6

6. I often question my moral character…….....1 2 3 4 5 6

7. I often question my own sanity…….....1 2 3 4 5 6

8. If other people really knew me, they would be afraid…….....1 2 3 4 5 6

9. I often question my own intentions or desires…….....1 2 3 4 5 6

10. I am sometimes afraid to look inside of myself because I am afraid of what I could find.
.....1 2 3 4 5 6

11. I feel like a bad part of me is always trying to express itself…….....1 2 3 4 5 6

12. I worry about being the sort of person who might do very immoral things.
.....1 2 3 4 5 6

13. I often worry about having a negative 'agenda'…….....1 2 3 4 5 6

14. I am afraid of the kind of person I could be…….....1 2 3 4 5 6

15. I often accuse myself of having done something wrong…….....1 2 3 4 5 6

16. I'm afraid of the kind of person I might become if I'm not very careful.....1 2 3 4 5 6

17. I often doubt that I am a good person…….....1 2 3 4 5 6

18. I fear becoming the sort of person I detest…….....1 2 3 4 5 6

19. I often feel that I do not honestly show the negative reality inside myself.
……...1 2 3 4 5 6

20. I must be very careful in order to avoid doing something awful…….....1 2 3 4 5 6

Inferential Confusion Questionnaire – Expanded Version (ICQ-EV)

Scale: 1 2 3 4 5 6

Strongly disagree	Disagree	Somewhat disagree	Agree	Somewhat agree	Strongly agree

1. I am sometimes more convinced about what might be there than by what I actually see……..…….....1 2 3 4 5 6

2. I sometimes invent stories about certain problems that might be there without paying attention to what I actually see…….....1 2 3 4 5 6

3. Sometimes certain far-fetched ideas feel so real they could just as well be happening…….....1 2 3 4 5 6

4. Often my mind starts to race and I come up with all kinds of far-fetched ideas. …….....1 2 3 4 5 6

5. I can get very easily absorbed in remote possibilities that feel as if they are real……...…….....1 2 3 4 5 6

6. I often confuse different events as if they were the same……...…….....1 2 3 4 5 6

7. I often connect ideas or events in my mind that would seem far-fetched to others or even to me…….....1 2 3 4 5 6

8. Certain disturbing thoughts of mine sometimes cast a shadow onto everything I see around me……...…….....1 2 3 4 5 6

9. I sometime forget who or where I am when I get absorbed into certain ideas or stories…….…….....1 2 3 4 5 6

10. My imagination is sometimes so strong that I feel stuck and unable to see things differently…….....1 2 3 4 5 6

11. I invent arbitrary rules, which I then feel I have to live by……..…….....1 2 3 4 5 6

12. I often cannot tell whether something is safe, because things are not what they appear to be…….…….....1 2 3 4 5 6

13. Sometimes every far-fetched possibility my mind comes up with feels real to me…….....1 2 3 4 5 6

14. I sometimes get so absorbed in certain ideas that I am completely unable to see things differently even if I try……...…….....1 2 3 4 5 6

15. In order to tell whether there is a problem or not I tend to look more for that which is hidden than what I can actually see…….....1 2 3 4 5 6

16. Even if I don't have any actual proof of a certain problem, my imagination can convince me otherwise……..…….....1 2 3 4 5 6

17. Just the thought that there could be a problem or something wrong is proof enough for me that there is…….....1 2 3 4 5 6

18. I can get so caught up in certain ideas of mine that I totally forget about everything around me…….….....1 2 3 4 5 6

19. Often when I feel certain about something a small detail comes to mind that puts everything into doubt…….…….....1 2 3 4 5 6

20. I sometimes come up with far-fetched reasons why there is a problem or something wrong, which then suddenly starts to feel real to me…..…….....1 2 3 4 5 6

21. I often cannot get rid of certain ideas, because I keep coming up possibilities that confirm my ideas…….….....1 2 3 4 5 6

22. My imagination can make me lose confidence in what I actually perceive.....1 2 3 4 5 6

23. A mere possibility often has as much impact on me as reality itself…….....1 2 3 4 5 6

24. Even if I have all sorts of visible evidence against the existence of a certain problem, I still feel it will occur……..…….....1 2 3 4 5 6

25. Even the smallest possibility can make me loose confidence in what I know. ……..1 2 3 4 5 6

26. I can imagine something and end up living it……...…….....1 2 3 4 5 6

27. I am more often concerned with something that I cannot see rather than something I can see…….…….....1 2 3 4 5 6

28. I sometimes come up with bizarre possibilities that feel real to me…….....1 2 3 4 5 6

29. I often react to a scenario that might happen as if it is actually happening.....1 2 3 4 5 6

30. I sometimes cannot tell whether all the possibilities that enter my mind are real or not…….....1 2 3 4 5 6